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ABSTRACT

This study looked at the use of a computer-based voice-interactive language learning system (VOXBOX) for teaching English as a Second Language. The intention of the study was to determine whether students who used VOXBOX as an exclusive instructional method could do as well as or better than students who used non-computerized, teacher-directed methods in improving the English-speaking proficiency level of limited-English-proficient (LEP) refugees seeking amnesty in the United States. A criterion-referenced instrument, the Basic English Skills Test (BEST) was used to measure the English proficiency gains between pre- and post-tests for an experimental and a control group. The experimental group used VOXBOX and the control group did not. Results showed that the VOXBOX students achieved significantly higher gains than the control group. It is concluded that VOXBOX ought to be considered as a serious tool to augment or even replace teacher-directed training efforts in teaching English as a Second Language. (Author/JL)

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AN EVALUATION OF VOXBOX, A COMPUTER-BASED VOICE-INTERACTIVE LANGUAGE LEARNING SYSTEM FOR TEACHING ENGLISH AS A SECOND LANGUAGE

A Dissertation

Presented to the

Graduate Faculty of the

School of Education

United States International University

In Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

U.S. DEPARTMENT OF EDUCATION
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by

Martin J. Petersen, Jr.

San Diego, 1990

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Abstract of Dissertation

AN EVALUATION OF VOXBOX, A COMPUTER-BASED VOICE-INTERACTIVE LANGUAGE LEARNING SYSTEM FOR TEACHING ENGLISH AS A SECOND LANGUAGE

by

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Committee Chairperson: Kendra G. Rosander, Ph. D.

THE PROBLEM: This study was an experimental study of the use of a computer-based voice-interactive language learning system (VOXBOX) for teaching English as a second language. The problem was to determine whether students who used VOXBOX as an exclusive instructional method could do as well as or better than students who used non-computerized, teacher-directed methods in improving the English-speaking proficiency level of Limited-English-Proficient (LEP) refugees seeking amnesty in the United States.

METHOD: A criterion-referenced instrument, Basic English Skills Test (BEST) was used to measure the English proficiency gains between pre and post tests for two groups, an experimental group (N=22) and a control group (N=22). The experimental group used VOXBOX and the control group did not; otherwise both groups received the same content.

RESULTS: The VOXBOX students achieved significantly higher gains, not only in overall (total) scores, but in each of the individual score categories of oral, reading and writing proficiency, and did so in fewer instructional hours than the control group students. Of the individual gains, the oral gain was the greatest and most significant. One reason for this improvement in gains, oral in particular, is that in a teacher-directed classroom situation, students (in this case all adults) may be intimidated or embarrassed to speak in public because they are afraid others may laugh at their poor use of English. Working alone and in private with VOXBOX, students may practice speaking in safety and comfort and compare their efforts with a recorded voice. The fact that fewer instructional hours were logged by the experimental group students using the VOXBOX equipment than by the control group students enrolled in the teacher-directed program is because the VOXBOX time is entirely engaged time, that is, time devoted exclusively to using the VOXBOX, whereas the control group's logged time may have included administrative time.

Suggestions were made for addressing some of the limitations of the research, such as expanding the population to include cultural and ethnic groups other than Spanish-speaking Mexican nationals, expanding the age range to include children as well as adults, and determining if gender and training time have any influence on the results.

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DEDICATION

To my dearest wife, Lucy, who has struggled against many odds to receive her California Teaching Credentials and has realized her dream of obtaining a Masters at the same time as I have realized my own dream of getting a Doctorate, I dedicate this effort to recognize her great accomplishments and to let others know that she is a magnificently talented person in her own right. The two of us walking across the graduation stage together, each receiving his or her own degree, has been as exciting a moment to me as I have ever realized. To our nine children, Laurel, Martin John, Lisa, Michael, Mark, Matthew, Lynn, Leslie, and Leigh Ann -- I dedicate this volume also, in hopes that they, too, may experience the thrill of reaching beyond the limits of their grasp as their parents have demonstrated, realizing that the Lord never gives us a challenge we cannot meet.

ACKNOWLEDGEMENTS

The first person I would like to thank is Alice C. Pack, Ph. D., member of my committee, and dear friend who got me started in this fascinating world of ESL, and whose invaluable expertise kept me going when the going got rough. I want to thank the other members of my committee, Dr. Karin Wiburg for her warmth and strength and great sense of humor, and Chairperson Dr. Kendra Rosander, who gave me Underwood's book and the inspiration to fly with it.

I am grateful for the talents and friendship of Stan Bolin, President of Intechnica International, Inc., whose brainchild, VOXBOX, will go down in history as a forerunner in the technology of using computers in language learning. Without Stan's sponsorship and commitment, this project would not have been possible. I also greatly appreciate Martha Hayes, of the Community Learning Center in Oklahoma City, for her relentless efforts in helping me gather the necessary data for the experiment. There are many others, too, without whose help or encouragement I could not have made it: Jim Whatoff, Mary Ellen Butler, Randall Phillips and John King, to name a few. I apologize for not being able to mention everyone's name, but I'm sure they will all receive blessings in some way.

No acknowledgement would be complete without thanking my wife, Lucy, for her long-suffering endurance while I followed my dream.

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Chapter 1

INTRODUCTION

Learning English involves developing skills in reading, writing, listening and speaking. According to Hope, Taylor, and Pusack (1984), computer-based language learning materials exist, but very little computer material is on the market, and much of what is available seems to be of little value. In this study, a new method of computer-based instruction designed for teaching English is investigated.

Background of the Problem

The number of people who need to learn to understand and speak English has risen dramatically since the close of World War II (Oliva, 1969). First, the proportion of non-English-speaking immigrants in the United States has been sharply increasing. Second, other areas of the world such as Asia, the Middle East, and Africa have expanded their economic and cultural relationships with the United States, causing an escalation of English language-learning activity in these places. Third, an increasing amount of information for both public and private consumption -- road signs, radio and television messages, and advertisements -- presented in a dual-language format is evidence that an increasing proportion of the global community is adopting English as a second language.

Statement of the Problem

There is both a need and a desire to develop methods, in addition to teacher-directed methods, for teaching people to understand spoken English and to speak understandable English. Language teachers are now earnestly investigating how the computer can serve them in the classroom (Hope, Taylor, and Pusack, 1984). Computers have helped reduce the student/teacher ratio by providing drill and practice in reading and writing, but the use of computers in providing listening and speaking practice is still in a state of infancy.

Traditionally, language labs have used audio cassette tapes to provide material for listening practice (Brooks, 1964). The cassette players may also have had microphones for oral practice. There are several problems with this approach. First, cassette tapes only store (and thus retrieve) audio in a sequential format. The material on the tape can only be presented to the student in an inflexible manner which cannot duplicate the spontaneity of a learning situation. Truly effective language acquisition, which emphasizes the flexibility of communication rather than the rigidness of grammar, requires an interactive environment which is random-access, not sequential, in nature. Second, if a student records his voice on tape, someone must listen to his efforts in order to evaluate his performance, thus negating the objective of maintaining a stand-alone facility. Third, the

effective teaching practice of immediate feedback is not available to students using cassette tapes as is possible with digital audio technology which allows direct and instantaneous computer interaction.

Since the 1950s, with the emergence of analog-to-digital conversion technology, computer storage devices such as floppy or hard disks have been capable of processing randomly-accessible audio information. However, conventional disk technology allows only a few moments of audio to be saved on a floppy disk, or a few minutes on a small hard disk, hardly worthwhile for practical applications. However, when laser disk technology became a reality in the mid 1980s, the ability to store and randomly retrieve several hours of audio on compact disks provided a practical solution to the problems of computerizing speech in a language lab environment.

Many students schooled in Japan learn from an early age to read and write English, but educators in Japanese schools do not overly concern themselves with oral language development (Handbook for Teaching Japanese-Speaking Students, 1987). This may be the result of insufficient accurate practice, possibly due to a lack of qualified personnel and/or technical facilities to help students in this much-needed learning activity. The use of computers as a self-study environment could be useful in expanding English study from reading and writing to include listening and speaking.

Purpose of the Study

The purpose of the study was to determine the effectiveness of a computer-based language-learning system that would provide reading, writing, listening and speaking experiences to students without the direct assistance of a teacher. The study was conducted to ascertain if students who used such computer equipment would test as well or higher in English language proficiency compared to students who had no access to such computerized facilities and who gained knowledge of English only by teacher-directed instruction.

Specifically, the study evaluated the effectiveness of VOXBOX, a computer-based voice-interactive language-learning system which incorporates all four elements (reading, writing, listening, and speaking) of language acquisition. VOXBOX, developed by Intechnica International, Inc., of Midwest City, Oklahoma, (formerly known as Intechnica Learning Systems, Inc.) is a computer hardware and software facility utilizing laser disk digital audio technology which allows a student to listen to interactively-accessible phrases which are spoken by a native English speaker, record his response to those phrases, and then receive instant computer feedback which allows him to compare his speech with that of the native English speaker.

Theoretical Framework

The assumption upon which this study is founded is that

the more a person practices listening to a foreign language and the more he attempts to speak it, the more fluent he becomes in that language. It is Underwood's opinion (1984:6) that "knowing rules..." (as demonstrated by reading and writing in that language in a safe and private atmosphere) "...is not the same as using them" (by speaking and listening in an actual social environment). Merely reading and writing the language does not make a person a better communicator in that language any more than reading a book about operating a car makes one a better driver. While reading and writing exercises have their place in helping students understand the rules of grammar, it is the listening and speaking practice that helps the student gain confidence in actually using the target language to communicate. A student attempting his first utterances in a foreign language is more encouraged by a reaction of being understood than he is by being graded on his use of grammar.

Research Question

The following research question was investigated:

Is the level of improvement in English language proficiency of students using VOXBOX as an instructional method equal to or higher than the level of improvement of students who use teacher-directed, non-computerized instructional methods, as measured by the Basic English Skills Test (BEST)?

Importance of the Study

English language proficiency is a key factor in every aspect of life in the United States and, in fact, any society where English is the primary language. It is difficult to seek appropriate work, to find adequate housing, to make intelligent purchases, or to be properly educated where a language barrier exists. The importance of language proficiency has been recognized by the United States government, as it required participants of the general amnesty program to demonstrate a basic level of English language proficiency as a requirement for United States citizenship.

However, the facilities for teaching English in general need to be upgraded. New methods need to be found which will provide this vital training in an effective yet economical manner. Educational institutions need to find better ways to bring students to an English proficiency level acceptable as a basis for learning other subjects. The importance of this study is that its results can be used as a basis upon which educational institutions, social agencies, and other groups involved or concerned with English language improvement may allocate budgets for the upgrading of English language training facilities.

Scope of the Study

The study was conducted using adult males and females who were Mexican nationals, whose native language was Spanish, and

who all were participants of a United States government sponsored amnesty program. One requirement of the amnesty program was that all participants receive forty hours of training in various subjects, the bulk of it being in English language proficiency.

The English language proficiency level of all participants was evaluated using the Basic English Skills Test (BEST), chosen because it evaluates all four elements of language acquisition (reading, writing, speaking and listening), and because it was designed specifically for immigrants arriving in the United States.

The participants were then divided into two groups. One group was assigned to study English using the VOXBOX equipment exclusively. The other group received direct instruction in a teacher-classroom environment. At the conclusion of the experimental period, both groups took the BEST test again.

Definition of Terms

The following definitions of terms were utilized for this study:

Acquisition is the process of acquiring knowledge of a subject without the benefit of formal training. Adults 'learn' a language whereas children 'acquire' one. Language acquisition is the process of using whatever one knows of a language to communicate, despite incorrect grammar, until the 'message,' the object of the communication, has been relayed

or understood.

Analog-To-Digital is the process of converting an audio signal to a digital form.

CAI (Computer-Assisted or Computer-Aided Instruction) is defined as being any instance in which instructional content or activities are delivered via computer. The usually-understood application meant by the term is drill and practice.

CALL (Computer-Assisted Language Learning) is a philosophy of language learning that stresses communication above grammar. That is, a person `acquires' a language by communicating with it, however crudely at first, until smoothness is achieved and grammar is eventually mastered.

CD-ROM (Compact Disk, Read-Only Memory) is a compact disk which holds approximately one thousand times more information than a floppy disk. It can only be `played' and not `recorded.' The original information on the disk can only be `burned' onto the disk at the factory, an expensive process costing from $1,000 to $2,000 per original disk. However, once the original disk, or `master' is created, copies can be made for only a few dollars per disk.

Compact Disk is a storage device, based on laser technology, which allows greater amounts of storage than either a floppy disk or a hard disk. A 4-1/2" laser, or `compact' disk, holds about 2,000 times as much information as

a 5-1/4" floppy disk.

Floppy Disk is a computer storage device that holds computer program information or digital audio information. A 365 kilobyte, 5-1/4" disk can hold about 12 seconds of audio.

Hard Disk is a computer storage device that holds a greater amount of information than the floppy disk. A 10 megabyte hard disk holds the equivalent information of about thirty 365 kilobyte, 5-1/4" floppy disks. In terms of audio information, this is about six minutes of audio.

Interactive describes the relationship between the computer program and the student, or user. This relationship must be 'free to follow the wind' in order for true communication to take place. That is, the computer presents material, the student responds to the material, the computer then responds to the response, etc.

Random Access is a computer term which refers to the directly accessibility a computer has to information stored anyplace on a floppy, hard, or compact disk. Computer programs, which may include audio information which has been converted to digital information, are stored on a floppy or hard disk in random order, which means that any piece of information can be directly accessed without having to 'skip over' other pieces of information. If there were thirty-five segments of information stored on the disk, the thirty-fifth segment could be retrieved just as fast as the first segment.

Sequential Access means `in serial order, one after another.' Audio segments are stored on a cassette tape sequentially, which means that you can't access the thirty-fifth segment unless you skip past the first thirty-four segments. If the cassette tape was currently cued to (located at) the beginning of the first segment, and the computer's next response to your input required it to play the thirty-fifth segment, the tape would have to be fast-forwarded to skip past thirty-four segments. The amount of time it would take for the tape player to do this demonstrates the reason why cassette tape, with sequential access, is impractical in an interactive environment.

Teacher-Directed is a method of instruction in which all learning is directed by the teacher and communication focuses on the teacher giving information and the student receiving it.

Chapter 2

REVIEW OF THE LITERATURE

Computers have made significant contributions in the areas of reading and writing, but, possibly due to the relative newness of the technology, not much progress has been made in listening and speaking. Therefore, before any discussion of whether or not computers can replace or augment teacher-directed methodologies in the language learning arena, an assessment of the importance of listening and speaking is necessary. Then it should be determined whether computers can deliver the quality and quantity of speech in as equitable a manner as non-computerized methods. Finally, just as educators argue over differences in methods of incorporating listening and speaking in curriculum design (enforced and graded drill and practice versus unrestrained and unmeasured access to language acquisition resources), courseware developers have differing philosophies regarding the use of computerized speech technology. With these factors in mind, the review of the literature discusses 1) the importance of listening and speaking in language learning, 2) the advantages and disadvantages of teacher-directed versus computerized methods of teaching listening and speaking, and 3) a comparison of philosophies in the use of computers to teach listening and speaking.

The Importance of Listening and Speaking in Language Learning

Because complete knowledge of a language involves reading, writing, speaking, and listening, Frommer (1989:51) was concerned that:

> one area of language learning that we are not addressing well, and in some cases not addressing at all, is listening comprehension, the act of understanding the oral message of a speaker. Traditionally, although language learning is assumed to involve four skills: reading, writing, speaking, and listening, many teachers concentrate only on the first three, often forgetting that comprehension and production are indissoluble partners, that conversation is interactive with speech and represents, at most, one half of communication. Such courses produce students who may be able to request directions to the hospital but will probably not be able to understand the answer, with the risk of dire consequences (Frommer, 1989:51)!

Hughes (1982) outlined two conflicting views on the nature of language proficiency. Referring to Oller's (1979) work in this area, he described the "Divisibility" hypothesis which states that language proficiency is capable of being broken down into a number of separately testable components, namely reading, writing, listening and speaking. The "Unitary Competence" hypothesis, on the other hand, describes language proficiency as being more like a viscous substance, not capable of being broken down into component parts. The implication here is that listening and speaking are part of the total picture of language learning, except that according to the divisibility hypothesis it is measurable and from the viewpoint of the unitary competence hypothesis it is not.

Robert Lado (1961), considered to be the "father of modern foreign language testing" pointed out that the four elements need to be treated and tested separately because mastery of the four skills does not advance evenly. He observed that someone may be a much better reader than a speaker, if indeed he or she can speak at all, and opines that for an accurate picture of a person's proficiency, each of the skills must be tested separately.

One reason why a person may be a better reader than a listener is given by Carroll (1971) who pointed out that it is far more difficult to receive a message by listening to it than by reading it because the listener must be continuously involved to listen and understand and to process and remember the information being transmitted. He stated that a reader may study a printed sentence over and over again until he understands it, but a listener usually has but one opportunity to digest a fleetingly uttered phrase. MacDonald (1989:27) added that:

> For the non-native speaker of a language, the written medium can provide security. When writing, the second or foreign language student has the opportunity to try to remember or to look up words or expressions, to alter grammatical structures, and to reorder the text, while proofing the material as many times as necessary. All this can be done in a private environment without an audience. In contrast, speaking involves immediacy, with no chance to take back what has already been said. In order for there to be native input or feedback, the novice speaker of a language must perform under the watchful often intimidating gaze of the fluent native speaker (MacDonald, 1989:27).

According to Torrey (1971), the goals of all language learning should include the ability to produce original sentences that conform to the rules of the language, to express one's own meanings in those sentences, and by the same rules to understand other people's utterances in the language. She believed the purpose of learning a language, whether it is the first or the fifth, is to create sentences, not to repeat them. She outlined ten basic propositions which have a direct bearing on all language learning, second as well as first. Her eighth proposition states that learning a language is learning to understand and to be understood by other speakers of that language. She reinforced the importance of separate training in reading, writing, listening and speaking. In her opinion, printed materials cannot replace spoken samples entirely, and writing cannot entirely replace speaking for practice. What an individual can do with writing he is not necessarily able to do with the spoken word; the transfer from one to the other is not complete either way. Many who have promoted audio-lingual methods feel that speaking is more basic than the other skills in the sense that it produces greater transfer.

Hartung (1989:np), a teacher for a foreign-exchange student program, opined in a personal interview that "While it is possible to learn about a language by reading about it in a book, or by writing practice exercises, one cannot communicate in that language without learning how to speak it

and to understand it as it is spoken." The organization she represents, The Foundation for International Understanding, caters to Japanese Junior High School and High School exchange students who come to America and live for several weeks with host families to learn about American culture. Prior to their arrival, these students had spent many years learning to read and write English in their own schools (starting as young as six years of age). In personal interviews with several host families who had sponsored Japanese students, the host family members consistently observed that, while their guests could communicate their needs by writing them down on a piece of paper, and while the host family members responded in a likewise manner, very little communication was understandable on a vocal level. The Handbook for Teaching Japanese-Speaking Students (1987) gives some insight why this situation existed. First, it was the Japanese custom for youth not to initiate a conversation (in any language) with an elder. The Japanese youth chose differentiated vocabulary and verb forms to speak politely to a "superior," and knew that the wrong use of expressions might constitute an affront to the superior status of the listener. These and other obstacles prevented the Japanese youth from exploring a language by vocalizing it in their own culture, but when they arrived in the United States and become braver in trying out the language with their American friends, their knowledge of the language increased dramatically. They learned that speaking and listening were

critical elements of language acquisition.

Many countries in the world share a seemingly common language. Consider the fact that England and America both have English as the official language. While most Americans can read and understand British books, magazines and newspaper articles, many Americans are hard pressed to understand speech spoken with a British accent, and vice-versa. Spain, Mexico and Venezuela all claim Spanish as their native language, but spoken communication between natives of these countries has its moments of difficulty due to differing ways of pronouncing words which, in print, would be recognized as being commonly understandable.

Listening is important not only as a "model" for the production of speech (listen-speak-read-write) in a language-learning environment, but should be an end in itself. Benson (1989) reported the results of a research project that investigated an ESL student's actual listening activities during one academic course at an American university. He concluded that content-based listening classes would be helpful in ESL preparatory programs.

The Advantages and Disadvantages of Teacher-Directed Versus Computerized Methods of Teaching Listening and Speaking

Educators are concerned if a computer, representing the "new technology" can do as good a job in teaching a student as teacher-directed methodology can. The answer is not easy, as the question is too vague. What is "a good job?" What is "teaching?" Whenever a new technology is introduced, there is concern about its effectiveness. Vockell and Schwartz (1988:13) illustrated this in a conversation between two educators:

> "This new technology will ruin education."
>
> "No, it won't. It will make education much more effective than it is now."
>
> "I see the problem as one of depersonalization! If this new technology is done well, it won't even be necessary to have teachers at all. Students will interact with technology rather than with human beings."
>
> "Not true! Teachers can permit students to learn basic information more efficiently from the new technology. Then the teachers will be able to use their own time to focus on individual needs. The result will be an increased quality of interactions between students and teacher."
>
> "But almost no students or teachers know how to use the new technology. They'll be dependent on unseen technologists and mysterious forces to control their learning."
>
> "Then maybe students and teachers will have to acquire a certain degree of literacy. The benefits will be worth the effort." (Vockell and Schwartz, 1988:13).

When this conversation between two educators took place

five centuries ago, the "new technology" was the increasing availability of the book. Now the "new technology" is the increasing availability of the computer; however these same concerns are expressed by educators today. There are bad computer programs, just as there are bad textbooks and bad teachers. Focusing on the subject of listening, concerned educators may wonder, in terms of learning, if a computer-controlled voice, which may or may not have robotic qualities, would be any better or worse than a human voice with a bad accent. Indeed, since many computer programs merely control a pre-recorded voice on disk or tape, whose fault is it if the voice quality is unacceptable? Is it the fault of the recording or of the computer which plays it? A lack of literacy certainly inhibits the full, effective use of textbooks as well as computers. However, Andelin (1987:85) stated that:

> conversations with teachers of Limited English Proficient (LEP) students indicate that these students have no more difficulty learning how to operate a computer than any other students. Even those who come from environments where they have never seen a computer adapt quickly to the physical tasks; they are no more computer-phobic than other youngsters (Andelin, 1987:85).

A major advantage of using computers to teach listening and speaking is that (providing the facilities exist) the student has control of the learning experience. Most educators concur that the best learning takes place when the student is ready to listen, not when the teacher is ready to speak. A human is not always available for language practice,

whereas the computer can be a 24-hour servant. A disadvantage, however, is that, although the computer has the future capability to be very intelligent as the sophistication of artificial-intelligence (AI) programming increases, it has limited decision-making or discriminatory powers. Consider the subtle nuances between the sounds of the words "color," "killer," "collar," "caller," and "cooler." A computer would be hard-pressed to be able to recognize the difference between these words spoken by a student into the computer's microphone. In an article captioned "Voice Recognition Becomes Feasible" (High Technology Business, 1989:38) a staff journalist reported that "At a recent IBM demonstration of its speech-recognition technology, the system heard the word `gobbledygook,' and decided it was `double deduct.'"

Hawkins (1989) described a $2,300 hand-held voice computer called "The Explorer," developed in 1989 by Advanced Products and Technology of Redmond, Washington, which demonstrated the capability of translating a user's voice from English to several foreign languages including Japanese, Spanish, French, Italian and German. The computer was activated by human speech instead of a keyboard. The user merely spoke a phrase into the computer, in English, and the computer translated the phrase into the chosen language and repeated it. Although the speech it produced was robotic-like, it was accurate and understandable. The computer had the capability of understanding and translating about 35,000

tourist-oriented English sentences. However, concluding that computers will replace human translators, one must realize that the above-mentioned voice computer had to be trained to react to the voice of its master. A user simply could not pick up the computer, speak into it, and have the computer be able to respond to the user as correctly as a human could. First the user had to undergo several weeks of interaction with the computer before the computer could reliably translate without error as the computer was required to learn the user's speech patterns and accent. This meant that the computer, having customized itself to a particular user, was not be able to understand another user without retraining, so it had limited use. Such a computer would certainly be inappropriate in an educational environment where a computer would have to serve many students.

From the "Spang-Robinson Report on Artificial Intelligence" (High Technology Business, 1989:36), the following summary gives an insight into the state of the art of voice recognition:

> Most speech-recognition systems available now recognize only isolated words that are clearly spoken with a pause between each word. Understanding natural, continuous speech is the big goal. There are two inherent problems in recognizing continuous speech: the complexities of acoustics and the properties of language itself. The acoustic issue includes distinguishing between like sounding consonants (such as v, b, and d), recognizing regional pronunciations, different vocal pitches, and various intonations (High Technology Business, 1989:36).

The working vocabulary of an educated adult is estimated

at between 10,000 to 15,000 words, which is far short of the 414,000 words contained in the Oxford English dictionary. The Spang-Robinson Report mentions that "current commercial (speech-recognition) systems fall into two categories - those that recognize a small vocabulary of 10 to 5,000 words, and those recognizing 5,000-plus words." However, there is a vast difference between having a computer recognize individual words and having a computer react to a combination of words as combined in a sentence which could be a statement, a question, or a command.

Hannafin and Peck (1988) described eight advantages and eight disadvantages in comparing the use of computers with teacher-directed methods of instruction. The first advantage is <u>increased interaction.</u> In a setting where a student sits and listens to a teacher lecture, interaction is practically non-existent as the student's thoughts typically wander during the lecture, and student response is typically limited to answering the teacher's occasional questions, if any at all. The computer, however, requires the student to respond to one exercise before proceeding to the next, thereby promoting student involvement in the learning process.

The second advantage of computer instruction is <u>individualization.</u> While it is true that individual lessons appropriate to individual learning needs can be accomplished in a human-teacher environment, the reality is that teachers' time for one-on-one instruction is limited, and the computer

is better equipped, by being more readily accessible, to address this issue.

Third, the computer is cost-effective (although this point may be arguable). A variety of students can be assigned different instructional segments at the same time with little supervision. Students are also able to use computers during evenings and on weekends without teachers being present. Once developed, a computer program is cost-effective to administer and distribute. Evidences of cost-effectiveness are given by Andelin (1987:65):

> Ten (State) coordinators were aware of evidence suggesting that the use of computers in Chapter I programs is cost effective. Six of these States had evidence to suggest that fewer instructional aides are needed and that more students are served when computers are used in the program, two States reported that computers allowed students to progress at a faster rate, and the remaining two States had evidence only pointing to the need for fewer aides when computers are used. State coordinators agreed that computers were much more expensive for drill and practice than workbooks, but felt that the extra costs are justified because students' time on task is increased significantly (Andelin, 1987:65).

The fourth advantage of computerized instruction is motivation. In addition to the idea that computers are in vogue, different students are motivated by various aspects of computer use, such as student individual interest, a non-threatening environment (depending on the friendliness of the software), and the degree of student control over the learning experience (again, depending on the features of the software.) Whenever the issue of motivation is raised, however, there has

been a persistent concern with equity of access, particularly in terms of possible differences between rich and poor, black and white, boys and girls, and limited English proficient students and fluent English speakers. Andelin's study (1987) pointed out that the gap between rich and poor was steadily narrowing. In 1985, black children were 30 percent less likely than white children to attend elementary schools with computers. Boys and girls were about equally enrolled in elective computer programming classes; there was no apparent gender difference among students in overall use of computers or in word processing during the regular school day although boys tended to dominate computer use during non-school hours. With respect to bilingual and English as a Second Language (ESL) education (programs designed for limited English Proficient students) there were important differences. Among regular classroom teachers who taught limited English Proficient students, 22 percent used computers. Among regular classroom teachers who taught other subjects, 50 percent used computers.

Immediate feedback is the fifth advantage computer facilities have to offer. Using teacher-directed techniques, a reading and writing exercise could take a significant amount of time. The student first reads the material. Then he rewrites the material according to instructions (example: rewrite this paragraph changing all singular words and/or phrases to plural). When finished, the student hands in the

work and waits for the teacher to grade it and return it to the student. Computer programs such as Word Works (Pack, 1987) provide instant feedback. As soon as the material is rewritten by the student, the effort is graded by the computer and the results are displayed instantaneously.

The sixth advantage of computerized instruction is ease of record keeping. As the computer guides the student through the learning experience, it can, if desired, keep track of all responses and compute appropriate scores.

A seventh advantage is lesson integrity. Whereas a teacher may never present the same material twice in the same way, the computer lessons are always presented in the same manner as the courseware designer intended them to be. No new material is added for one student and not for another. Likewise, no material is omitted so the lessons are consistently uniform for all students.

Finally, the eighth advantage of computer instruction is student control. This depends, of course, on the quality of the software. Usually, however, the student can control the speed of presentation, the amount of practice before testing, and even the order of instructional sequence.

Computer-assisted instruction, however, has an equal number of disadvantages. First, there is the need for expensive hardware and software. In Andelin's paper (1987), a State coordinator remarked that a computer costs $2,000, but a workbook costs only twenty-five cents. The expense of the

hardware applies not only to the original investment, but to the maintenance costs. The situation is further complicated by the fact that there is incompatibility between software of different computer types. For instance many schools, having originally invested in Apple Computers found that IBM software was more suitable for their purpose but was incompatible with their computers.

An additional factor is the limited availability of ESL software. Based on data extracted from The Educator Software Selector (TESS) database, May, 1986, only thirty four programs were available for English as a Second Language compared to 1,648 for math and 1,013 for science.

Another disadvantage is the difficulty of reviewing topics. Hannafin and Peck (1988) stated that since it was inherently more difficult to find an available computer than it was to pick up a workbook, it followed that the difficulty was increased by situations, such as reviewing for a test, where many students would need to access computers in a short time.

To date, there is a heavy reliance on reading and visual skills where the use of computers is concerned. Keefe (1979) mentioned that students have dissimilar learning styles. Dunn (1983) described four basic perceptual learning channels: visual learning, auditory learning, kinesthetic learning (experience), and tactile learning (hands-on). Some students acquire knowledge more comfortably by listening to a lecture

than by reading a book. Others need hands-on experience in order to learn efficiently. Today the state of the art of computer technology is such that the main interface between the computer and the student is the keyboard, thus demanding a high reliance on reading and writing for interaction with the computer. But the situation is changing. The effectiveness of voice technology is increasing, and the prediction is that computers will be able to speak and listen with a satisfactory degree of reliability.

The fourth objection to computer instruction, at the time Hannafin and Peck tabulated their results, was unrealistic graphics. However, this limitation is no longer valid. As computers have gained (and continue to gain) the capability of increased memory (a requirement for good graphics), the objection becomes moot. If anything, graphics have the advantage of being better than graphics portrayed in a workbook because they can be animated.

Fifth, computer instruction is limited by the expertise of the courseware developer. Where text, graphics and handout material can be locally generated by teachers or support personnel with limited difficulty, a greater amount of skill is required to develop computer courseware. This objection also ties in with longer development time since computer courseware is more complicated than its non-computerized counterpart.

The possibility of limiting incidental learning is a

result of computer programs being typically efficient. In a live learning situation as opposed to a computerized one, the teacher is more likely to augment the lesson with additional materials.

Finally, the eighth objection to computer instruction is that the computer does not recognize the condition of the student. Good teachers can adapt instruction to accommodate the student's present state of mind at the time of instruction, taking into account the student's physical and emotional condition.

Given that the use of the computer for curriculum presentation has its advantages and disadvantages, what factors decide where, when and how computers should be used? The question in a general sense is too broad to answer sensibly. More thought needs to be given to the factors that determine whether computers can be successful in a language-learning environment. Vockell and Schwartz (1988) indicate that a theory-based framework is needed for making decisions about the computer's place in the curriculum. They recommend using academic learning time as the major factor in deciding whether or not to use computers for instruction. They take the position that, whatever the subject area, academic learning time is likely to be more strongly related to academic success than any other variable over which the teacher can exercise control.

According to Vockell and Schwartz, Academic learning time

(ALT) is divided into three parts. The total time available for the learning task is called Scheduled Time, for example, one hour is scheduled for learning English. Within the Scheduled Time is Allocated Time. During the Scheduled Time there may be some administrative details such as calling the roll or passing out materials. If ten minutes of Scheduled Time is used for these purposes, then fifty minutes is left for Allocated Time. The final division, Engaged Time, is the portion of Allocated Time actually used for the learning experience. Vockell and Schwartz also mentioned that not all students will spend all the time allocated to a task actively engaged in appropriate activities. Students may daydream because they are bored while a teacher is lecturing, or stop to examine an insect crawling across the floor instead of doing their seat work. For engaged time to be useful, the student must be participating in useful activities at a high rate of success. They concluded that the computer can make an important contribution to Academic Learning Time. If a computer program is good enough to keep the student engaged, then Academic Learning Time is more successful because Engaged Time increases.

Another factor in deciding whether computers can be effective in language learning is the quality and quantity of the speech the computers generate or control as compared to real or live speech generated by a teacher. First of all, the assumption that live human speech is the standard by which all

else is judged is invalid. Given one hundred settings where a group of students meets with a live teacher for the purpose of language instruction, there will be one hundred variations of the language the students are trying to learn, as no two teacher's accents or voice inflections are the same. What, then, should be the standard? Should a "model" voice be recorded and distributed as the standard. Pack (1989) disagreed with this idea. She felt that a person who learns a language by listening to a model voice will never be able to understand real speech spoken by real people. In that regard, then, is recorded speech as good as live speech, given that the technical quality is the same? If recorded speech is as acceptable as live speech in a language learning environment, is computer-generated or synthesized speech equally acceptable? Pack again pointed out that it is not so much the quality of speech (the aesthetic quality as opposed to the technical quality) that makes the difference, but the variety of speech. If computer-generated speech could emulate the many accents and inflections of human speech, would this not be equally as effective as real speech?

Hope (1984) described the advantages and disadvantages of using recorded speech controlled by the computer as compared to using synthesized speech generated by the computer. Recorded speech takes more storage space than synthesized speech. In the case of the "Explorer" voice computer mentioned earlier, if the 3,500 tourist-oriented sentences

used by the computer were pre-recorded and stored digitally, the computer would have to be carried in a suitcase instead of being hand-held. Synthesized speech requires virtually no storage. It is generated as needed by the computer's artificial intelligence circuitry. Recorded speech requires a longer time for the computer to search and deliver the appropriate passage (from several seconds to a minute) than it takes for a computer to generate the speech with a voice synthesizer (three-tenths of a second in the case of the "explorer" computer).

Thus, if the appropriate computerized voice technology is matched to the language-learning task at hand, computers have the capability of achieving success in language instruction. If speed of interaction between student and computer is of prime importance, then synthesized speech would be preferred to recorded speech. If speed was still important, but voice quality was also important, then a computer controlling speech stored on a computer disk or a compact disk would be preferred to speech saved on a cassette tape where access time is severely restricted.

Salazar (1989:67) outlined some interactive audio strategies for developing listening skills which exploited the capabilities of the computer-controlled laser audio disk (compact disk). Assessing the situation, he declared "It is only in the last five to ten years that instructional materials specifically focused on building listening

comprehension skills have begun to emerge." Activities in four listening sub-skill categories were described: recognizing vocabulary, discovering paraphrases, predicting discourse and transcribing (taking dictation).

Parker and Davis (1989:75) described what was considered to be the state-of-the-art in digital audio systems for use in language instruction:

> The system consists of networked personal computers with digital audio adapters. The use of a digital audio adapter allows for the flexible manipulation of audio materials: natural sounding audio may be played, recorded, replayed, paused, and ordered under computer control with no distracting delays or distortion. In addition, audio can be coordinated with the display of text or graphics on the computer screen. Finally, the network allows for the central storage of the digital audio material and computer programs. Only a single copy of any audio material needs to be produced and stored on a network file server. This material is then available for selection at any time for independent use by any number of students (Parker and Davis, 1989:75).

This approach is the one taken by VOXBOX, except that a compact disk player, which increases storage capacity tenfold, replaces the network file server.

Speech analysis is another subject of concern to educators, and is an area where computers can be decidedly advantageous. Consider the classic situation of Japanese students trying to say words like "luck" or "wallet." Since the letter "L" is not in their library of sounds, the words come out "ruck" and "warret." What is more serious than not being able to say the "L" sound, however, is that they don't recognize even when listening to a recording of themselves

that they have said it wrong. The teacher-directed cure for this would be to have the student work one-on-one with a person trained in speech therapy who would explain factors like tongue placement and serve as a critical listener, advising the student when and if he pronounced the sound correctly. A high-tech solution to this problem was given by Arcell (1990) who described his company's portable speech lab, a computerized speech analysis tool. He stated that his company's product, Visi-Pitch, provides real-time visual feedback for spoken second language training and 'accent reduction'. As the student speaks, speech patterns are immediately displayed on a high resolution color screen. Attention can then be focused on problem areas revealed by these simple representations of the student's speech. Split screens allow the simultaneous display of the instructor's model pattern and the student's attempt to replicate it. Intonation, stress and timing patterns can then be visually and statistically compared. In the case of the aforementioned Japanese student who could not tell he was erring even by listening to his own voice, devices like Visi-Pitch would show him, by visual comparison, where he needed to improve.

A final thought on the issue of whether computers are more or less advantageous than traditional methods was given by Knutsen and Nolan (1974) who declared that many of the most important benefits of a computer-based system are not

susceptible to auditable gratification, referring in part to the preference many students have in using computers over other resources.

A Comparison of Philosophies in the Use of Computers to Teach Listening and Speaking

Given that the arguments in favor of using computers to teach listening and speaking have gained acceptance, the next area of concern is how they should be used. Should the use of computers be voluntary or mandatory? That is, should the student be forced to used the computer to complete given exercises, or should the computer be available as an extra resource to be used or not as determined by the desire of the student? If the student uses the computer, should the computer program strictly control the learning experience, rewarding the student for every little victory, punishing him for every failure, and recording every detail of the student/computer interaction, or should the computer take a more relaxed, human-like approach and give the student some leeway?

The two basic philosophies underlying these differing viewpoints are represented in Computer-Assisted Instruction (CAI) and Computer-Assisted Language Learning (CALL). Hannafin and Peck (1988:5) describe CAI as "any instance in which instructional content or activities are delivered via

computer. As such, CAI is an educational medium with its own unique set of strengths and limitations. CAI can be effective or ineffective, interesting or boring, good or bad." In common use, CAI has the reputation of being used mostly for drill and practice. From a technical viewpoint, since CALL is also an environment where the computer is used to deliver instruction, CALL may be said to be a subset of CAI. But Underwood (1984) describes CALL as being a communicative rather than a drill-and-practice approach to language learning. There are thirteen premises that differentiate CALL from CAI (Underwood, 1984:52-53) and, if the ultimate use of the computer is for language learning, the curriculum administrator needs to weigh the advantages and disadvantages of each philosophy. These premises deal with 1) acquiring rather than learning, 2) presenting implicit rather than explicit grammar, 3) generating original utterances, 4) not being judgmental, 5) avoiding telling students they are wrong, 6) not rewarding students for good behavior, 7) not being cute, 8) using the target language exclusively, 9) being flexible, 10) allowing students to explore the subject matter, 11) creating a natural environment for using the target language, 12) not merely mimicking what a book could do as well, and 13) being fun to use.

The first premise of CALL is that it concentrates on language acquisition rather than learning. Learning implies measurement of results, whereas acquisition is non-judgmental.

A feature of a CALL program, as opposed to a CAI program, is that there is no drill.

Second, grammar is implicit rather than explicit. Underwood felt that it is more important to learn how to communicate in a language and then gradually acquire the correct grammar as communication skill increases.

Third, the essence of CALL is to encourage the student to generate original utterances rather than manipulate prefabricated language. This is aided by the fourth and fifth premises of CALL, which is for the computer not to sit in judgment on every effort the student makes, and to allow him to make mistakes.

The sixth premise of CALL is the natural opposite of the previous premise. Just as it is not good to punish a student for his mistakes, it is not necessary for the computer to "reward" a student with bells and whistles when he is right. Underwood believes that when a student is using language to try to solve a problem or achieve some goal, success will be sufficient reward in itself.

Neither will CALL be "cute," like having the computer, in a patronizing way, say "Ooh, la, la. Eet eez right" as a congratulatory message in a French lesson.

A major difference in CALL methodology over a typical CAI program is that the CALL program uses the target language exclusively. Some say this cannot be done, but critics only need to think of imaginative ways to portray thoughts and

ideas to realize that words are not always necessary to describe them.

Another premise of CALL is that it should be flexible. Just as a human teacher can respond in a variety of ways to a student's query, so can a computer. They do not have to be any more "rigid and inhuman" than the people who program them.

Pappert (1980:5) argued that "the child should program the computer" rather than vice-versa. What he was referring to was the tenth premise of CALL that the computer should allow the student to explore the subject matter. The CALL programs should not lock a student into a fixed pattern, but should allow him to explore the material in whatever order interests him.

A CALL program should also create an environment where the target language seems natural. Computer language learning need not be limited to a one-on-one arrangement between a student and a computer. A small group of students could interact with each other with the computer serving as a catalyst or a moderator.

One way to judge whether a computer program meets the CALL criteria is to decide whether the computer program in question is merely mimicking what a book could do just as easily. If it is no better than a workbook, it is not a CALL program.

Finally, a CALL program should be fun. A popular program installed on the language lab computers at United States

International University's centers in Osaka and Tokyo, Japan, is a vocabulary-building program called SPLASH (Petersen 1989). The SPLASH program puts the player on a pirate ship, and he must determine vocabulary words from clues or face the possibility of becoming shark-bait.

The above comparison of philosophies does not imply that one is better than the other. There is a place for the freedom and exploration espoused by the CALL approach, just as there is a need for the drill and practice that CAI programs provide.

Chapter 3

RESEARCH METHOD AND PROCEDURES

Research Design

This study evaluates a specific computer-based language learning system for the purpose of determining its capability of improving English language skills of learners. The design isolates the improvement (or lack thereof) of skills due solely to the effect of the learning method, and eliminates any influence of different instructional materials, national origin, native language, or other external factors on the results by keeping these variables as similar as possible. A pre-test/post-test control group design was chosen and an experiment was conducted. The data gathered from the experiment were analyzed using t-tests for correlated groups to answer the research question.

Research Question Restated

The research question is restated from Chapter One: "Is the level of improvement in English language proficiency of students using VOXBOX as an instructional method equal to or higher than the level of improvement of students who use teacher-directed, non-computerized instructional methods, as measured by the Basic English Skills Test (BEST)?"

Subjects

The Community Learning Center of Oklahoma City conducted a training program for illegal aliens who were the participants in a United States government amnesty program. Partial requirements of this program specified that these participants must receive training in English language skills as a precondition for United States citizenship. The subjects for the research design were male and female Spanish-speaking young adults of Mexican nationality who had little or no formal education.

Instruments Used

The Basic English Skills Test (BEST) used for pre and post testing was originally designed in 1982 for newly arrived Southeast Asian refugees in adult education programs (Alderson, Krahnke, and Stansfield, 1987). It measures reliably and accurately the language skills of low-level students. The BEST tests listening comprehension, speaking, reading, and writing, and consists of two sections: an Oral Interview section, originally known as the Core section (93 points maximum) and a Literacy Skills section (78 points maximum). The test has been widely used to provide information on students' language proficiency upon entrance in a language program, and as an achievement test to measure students' progress. The Oral Interview section of the test provides the student with live oral stimuli, pictures, and

writing on a one-to-one basis. The Literacy Skills section gives students oral as well as written directions. Students respond by speaking, writing, and pointing in the Oral Interview section, but respond only by marking or writing in the Literary Skills section.

The Oral Interview section tests communications skills, fluency, and listening comprehension. These sub-sections are scored separately by the examiner but, for purposes of this experiment, only the total score of the Oral Interview section, referred to in this experiment as the "Oral Score" is recorded. This "Oral Score" represents overall listening and speaking (communication) ability. The Literacy Skills section tests reading comprehension and writing ability. For purposes of this experiment, each score is recorded separately and referred to as the "Read Score" and the "Write Score," respectively.

There were several factors that influenced the decision to use the BEST test as the appropriate instrument for this experiment. First, it measures and separately scores the vital but diverse aspects of English language skills: reading, writing, listening, and speaking (communication and fluency). The main benefit of the VOXBOX method of instruction is that a computer provides training in listening and speaking as well as reading and writing; therefore it was desirable to measure gain in these areas. Second, the instrument was designed for a group of people with similar characteristics to the

population addressed by this research: non-native-English-speaking immigrants with low-level ability in English skills. Third, the BEST, unlike the TOEFL (Test Of English as a Foreign Language), is designed to be locally administered and scored on demand, and the results are not influenced by considering other groups taking the same test. It is a criterion-referenced, not a norm-referenced instrument.

The Kuder-Richardson (KR-20) reliability (Erickson and Wentling, 1976) for the four separate parts of the Core section range from .73 to .91. On the Literacy Skills section the reading part showed a reliability of .96, while the writing part showed a reliability of .89. In field tests of validity (Alderson, Krahnke, and Stansfield, 1987; Best, 1977) the Core Section was found to be valid in that it discriminated between various levels of language proficiency. The Literacy Skills section of the test, however, was too difficult for the lowest level students and for students with little education.

Research Procedure

Two facilities, both of them being community learning centers funded to provide English language training for the United States amnesty program, were chosen to conduct the experiment. One facility had a computer lab which was equipped with four VOXBOX units, the other had no computer lab and was designed for teacher-directed classroom training. The

fact that these learning centers were in different parts of the same city, each in neighborhoods similar in socio-economic status and ethnicity, and the fact that the candidates for the amnesty program generally went to the center closest to where they lived, satisfied the random conditions required for the experiment.

The prospective subjects at each learning center were interviewed personally to determine national origin, and native language. From this list, only those whose native language was Spanish and whose national origin was Mexico were chosen and given a pre-test in basic English skills, utilizing the Basic English Skills Test (BEST) for this purpose. The results of the BEST oral interview section, which consisted of raw scores in communication, fluency and listening comprehension were recorded separately. The reading and writing scores from the BEST literacy skills section were also recorded separately. The birth date of each qualified subject was recorded as well as the pre-test date. The difference between dates was the basis for determining the participant's age.

The subjects in each group received approximately thirty hours of training in English proficiency. The students in the experimental group met at the computer-based learning center. There were four computers available at this center which were configured with the VOXBOX equipment. The VOXBOX method is designed for self-paced learning. Instructions pertaining to

the use of the system were given by VOXBOX to the student in the Spanish language. Realizing that computer literacy can be a limiting factor in the educational process, the VOXBOX software was designed to make maximum use of a light-pen, a device where the user would respond to a computer's query by touching an appropriate box on a computer screen rather than by searching for a key on the keyboard. There was a person in charge of the computer lab in attendance at all times to help the student with the use of the computer, but not to give instruction in English language skills.

The students at the other learning center (the control group) were given teacher-directed training in English language skills. The students met in a classroom where a teacher lectured to the students and then gave classroom assignments. At the conclusion of the instructional time period allotted to each student, the Basic English Skills Test (BEST) was re-administered as a post-test to all participants. The post-test date was recorded, and the difference between the post-test and pre-test dates determined the length of the instructional period. At the time of the post-test, the number of hours of actual instructional time was recorded.

The instructional material used by both groups was identical. The VOXBOX material was, in fact, a computerized version of language workbooks developed by Orbis Company, of Vista, California. While this material was presented to the experimental group via computer, the control group received

the same material in printed workbooks. Appendix C, INFORMATION ON VOXBOX, tabulates the subject material and lesson content found in these workbooks.

At the close of the experimental period, twenty-six subjects from the experimental group and forty-five subjects from the control group had completed their training. Their birth dates, pre-test dates, pre-test oral, read and write scores, post-test dates, post-test oral, read and write scores, and number of hours of instruction were the data used to analyze the results of the experiment.

Data Analysis

The data were analyzed using the correlated or matched-pair method of analysis. The candidate lists for the experimental and control groups were arranged in ascending order by total pre-test score (the sum of Basic English Skills Test (BEST) oral, read, and write scores), resulting in twenty-two matched pairs. Student's t-tests for correlated pairs were performed within each group to determine gain significance. The t-test for independent groups was performed to answer the research question. The Pearson correlation coefficient (r) test assessed the validity of the test instrument Standard deviations of all means were calculated to determine the quality of the gains.

The subjects were matched by oral scores, by read scores, and by write scores to add further enlightenment to the

research findings.

Assumptions

The assumptions made in conducting this research were that: 1) the candidates who used the VOXBOX computer equipment would not be chosen for any particular ability or desire (or lack thereof) to use a computer, 2) the candidates would receive no additional training or scheduled exposure in English language skills beyond their scheduled thirty-hour experience (extra homework, extra VOXBOX sessions, etc), and 3) the candidates from either group would not discuss their training methods with each other. It was further assumed that any differences in age or gender would not significantly affect the results.

Limitations

The limitations of the study were due largely to the limited availability of the VOXBOX hardware and software. Each VOXBOX system can service up to eight computers. At the time this research was conducted, a facility with four VOXBOX computer stations was the largest that could be found that was willing to conduct the experiment. Several sections of control group/experimental group sessions were conducted to accommodate as many qualified candidates as could be found. The VOXBOX software, while ultimately destined to be available in all popular native languages, was available at the time of

the study only for Spanish-speaking students.

A shortage of qualified subjects was another limitation. Rather than having the availability of large numbers of subjects who could have, collectively, completed the requirements of the experiment in a short time, the subjects appeared at sporadic and long intervals, causing a delay in gathering the data. It would have been preferred to have each subject perform his training assignments within a given, fixed time, so that the interval between pre and post testing would be consistent. However, due to the highly transient nature of the participants, the number of weeks between testing and the number of hours of instruction varied widely.

Chapter 4

RESEARCH FINDINGS

This chapter presents the analysis of the data obtained from the experimental and control groups. The research question is tested against the results. Anecdotal information is given to shed further light on understanding the findings.

Analysis of Data

Twenty-two pairs of subjects were matched on pre-test total BEST scores (the sum of BEST oral, read and write scores). The range of score matching was from zero (an exact match) to six (the point spread which represents the standard error of the Basic English Skills Test (BEST). The detailed listings of these experimental group and control subjects are shown in Tables 1 and 2 respectively. The subjects are listed in paired order, i.e., the first subject listed in the experimental group is paired with the first subject listed in the control group, and so on.

Table 1

Experimental Group Subjects, Ranked in Ascending Order by Pre-test Total Scores

SUBJECT			PRE-TEST				TIME		POST-TEST				GAIN
ID	S	AGE	O	R	W	TOT	WK	HR	O	R	W	TOT	TOTAL
147	M	32	26	5	1	32	11	22	31	9	5	45	13
103	M	23	24	7	13	44	11	34	54	7	14	75	31
114	F	32	14	16	14	44	2	40	20	11	9	40	-4
104	M	25	45	7	4	56	11	18	53	7	10	70	14
105	M	23	56	1	3	60	6	18	64	29	15	108	48
106	M	21	48	10	4	62	29	26	75	28	15	118	56
107	M	25	54	8	3	65	8	18	53	12	10	75	10
144	M	25	30	29	16	75	14	18	74	25	18	117	42
140	M	25	50	14	11	75	4	16	75	12	11	98	23
115	M	28	43	18	17	78	7	14	51	20	17	88	10
121	F	19	42	23	16	81	11	12	60	27	10	97	16
110	M	19	53	23	15	91	11	24	68	27	10	105	14
102	M	19	63	20	16	99	30	30	73	30	14	117	18
143	M	24	51	38	16	105	8	30	53	22	15	90	-15
120	F	32	66	31	15	112	8	30	65	32	15	112	0
138	M	36	88	30	6	124	11	40	89	35	22	146	22
127	F	43	74	32	20	126	18	36	86	43	25	154	28
112	M	25	78	32	19	129	5	24	78	40	18	136	7
123	M	25	89	30	16	135	13	8	85	40	20	145	10
145	M	24	78	36	24	138	56	20	91	42	25	158	20
136	F	51	89	35	23	147	38	56	88	40	27	155	8
135	M	26	87	43	19	149	18	28	91	42	23	156	7
22		27	57	22	13	92	15	26	67	26	16	109	17.2

Explanation of column headings and symbols:

ID = case number of subject
S = sex of subject
AGE = age of subject at time of pre-test
O = BEST oral score (Core section total)
R = BEST read score (Literacy Skills section)
W = BEST write score (<Literacy Skills section)
TOT = sum of oral, read, and write scores
WK = time in weeks between tests
HR = number of hours of instruction

Table 2

Control Group Subjects, Ranked in Ascending Order by Pre-test Total Scores

SUBJECT ID	S	AGE	PRE-TEST O	R	W	TOT	TIME WK	HR	POST-TEST O	R	W	TOT	GAIN TOTAL
201	M	36	20	8	7	35	9	48	22	8	9	39	4
232	F	32	10	12	16	38	17	68	25	21	17	63	25
214	M	42	41	1	8	50	17	70	40	1	9	50	0
236	F	23	29	14	12	55	12	40	18	18	16	52	-3
217	M	26	31	15	11	57	17	48	43	18	19	80	23
206	M	31	41	12	8	61	8	53	32	20	16	68	7
212	M	40	48	5	9	62	10	40	5	14	16	35	-27
243	F	34	41	18	17	76	24	65	55	18	14	87	11
242	F	27	32	27	16	75	13	45	54	22	20	96	21
211	M	30	45	23	13	81	12	63	49	28	15	92	11
209	F	27	33	32	18	83	8	38	47	34	15	96	13
207	M	32	41	31	19	91	13	10	41	32	18	91	0
218	M	29	61	20	19	100	14	68	64	24	17	105	5
222	M	26	65	29	17	111	9	33	76	41	19	136	25
227	M	33	48	45	22	115	16	45	66	46	21	133	18
208	M	29	54	46	25	125	10	25	67	45	23	135	10
202	M	33	63	43	22	128	19	38	74	44	21	139	11
238	F	28	71	43	19	133	8	18	79	40	25	144	11
220	M	29	70	43	21	134	9	38	80	43	29	152	18
229	F	34	71	43	25	139	16	23	56	42	29	127	-12
228	M	22	71	45	29	145	11	35	71	43	24	138	-7
223	M	26	72	47	29	148	15	73	78	45	29	152	4
22		30	48	27	17	93	13	45	52	29	19	100	7.5

Explanation of column headings and symbols:

ID = case number of subject
S = sex of subject
AGE = age of subject at time of pre-test
O = BEST oral score (Core section total)
R = BEST read score (Literacy Skills section)
W = BEST write score (<Literacy Skills section)
TOT = sum of oral, read, and write scores
WK = time in weeks between tests
HR = number of hours of instruction

Table 3

Profile of Paired Subjects by Gender, Age, Duration of Experiment (weeks), and Instructional Time (hours)

GROUP	MALE	FEMALE	TOTAL	AGE	WEEKS	HRS
Exper.	17	5	22	27.4	15.0	25.5
Control	15	7	22	30.4	13.0	44.7
Combined	32	12	44	28.9	14.0	35.1

AGE = average age of subject at time of pre-test
WEEKS = number of weeks between pre and post testing
HRS = number of hours of training

Table 3 displays a profile of paired subjects by gender, age, duration of experiment (the time in weeks between pre and post testing), and the instructional time in hours. It shows that the majority of the subjects were male. The average age of the subjects was 28.9, with only a three year difference between the experimental group and the control group. From Table 1, the age range of the experimental group was 19 to 51, and from Table 2, the age range of the control group was 22 to 42. The details of age distribution are listed in Table 4. The age spans (range) were 32 and 20, respectively.

Table 4

Age Distribution of Subjects

EXPERIMENTAL GROUP AGE	FREQUENCY	CONTROL GROUP AGE	FREQUENCY
19	XXX		
21	X		
		22	X
23	XX	23	X
24	XX		
25	XXXXXX		
26	X	26	XXX
		27	XX
28	X	28	X
		29	XXX
		30	X
		31	X
32	XXX	32	XX
		33	XX
		34	XX
36	X	36	X
		40	X
		42	X
43	X		
51	X		
	22 cases		22 cases
mean =	27.36	mean =	30.41
SD =	29.08	SD =	31.52

The average period of time, in weeks, between the pre-test and the post-test was 15.0 weeks for the experimental group and 13.0 weeks for the control group. Table 5 displays the details of the distribution. The range is 54 weeks for the experimental group compared to 16 weeks for the control group.

Table 5

Experimental Time Period Distribution of Subjects

Number of weeks between pre and post test

EXPERIMENTAL GROUP WEEKS	FREQUENCY	CONTROL GROUP WEEKS	FREQUENCY
2	X		
4	X		
5	X		
6	X		
7	X		
8	XXX	8	XXX
		9	XXX
		10	XX
11	XXXXXX	11	X
		12	XX
13	X	13	XX
14	X	14	X
		15	X
		16	XX
		17	XXX
18	XX		
		19	X
		24	X
29	X		
30	X		
38	X		
56	X		
	22 cases		22 cases
mean =	15.00	mean =	13.04
SD =	19.98	SD =	14.01

Table 6 shows the distribution of the instructional hours for each group. The control group averaged considerably more hours of instruction than did the experimental group. The range in hours was 48 for the experimental group as compared to 63 for the control group.

Table 6

Instructional Time Distribution of Subjects

Number of hours of instruction

EXPERIMENTAL GROUP HOURS	FREQUENCY	CONTROL GROUP HOURS	FREQUENCY
8	X		
		10	X
12	X		
16	X		
18	XXX	18	X
20	X	20	X
22	XX		
24	XX		
		25	X
26	X		
28	X		
30	XXX		
		33	X
34	X		
		35	X
36	X		
		38	XX
40	XX	40	XX
		45	X
		48	XXX
		53	X
56	X		
		63	X
		65	X
		68	X
		70	X
		73	X
		75	X
	21 cases		21 cases
mean = 25.55		mean = 44.73	
SD = 28.40		SD = 49.07	

Table 7 lists the details of the scores and gains for each group in terms of gender and age distribution, time period between pre and post testing, and hours of instruction. The total pre-test score average is nearly identical for both groups because the groups were matched on pre-test total scores. The overall gain of 17.2 for the experimental group represents a 10.1% increase, while the overall gain of 7.6 for the control group is a 4.4% increase. In terms of ratios, the experimental group gain is 2.26 times higher than the control group gain.

Table 7

Average Pre-test and Post-test Total Scores

	PRE TEST		POST TEST			
GROUP	MEAN	S.DEV.	MEAN	S.DEV.	GAIN	S.DEV.
Exper.	92.1	36.2	109.3	35.3	17.2	16.5
Control	92.8	36.6	100.5	38.1	7.6	12.7

Note: maximum total score is 171

Figure 1 is a bar graph depiction of the Table 7 data.

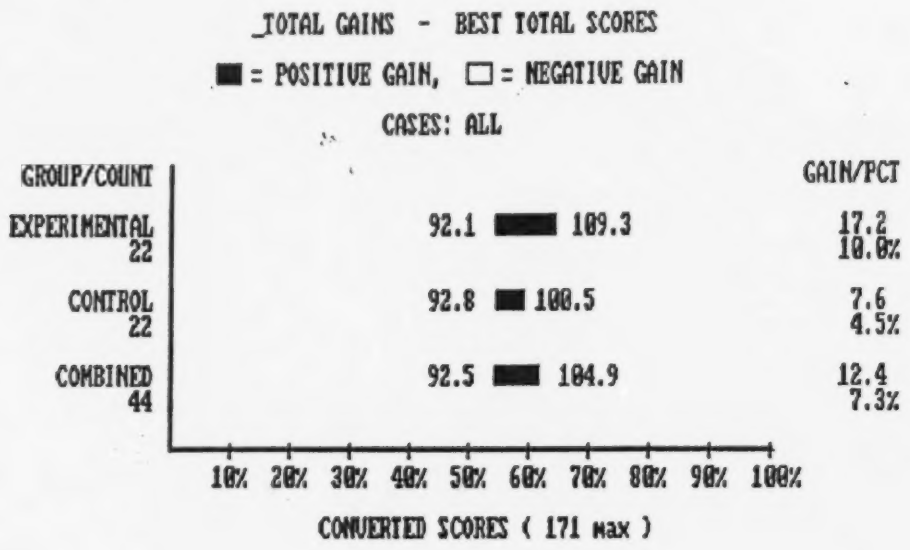

Figure 1

Pre-test and Post-test Total Scores and Gains

Table 8 lists the results of the t-test analyses performed on the gain data. A t-test for correlated groups was performed on the experimental group where the pre and post BEST test scores for each subject served as the correlation standard. A similar test was performed for the control group. Finally, a t-test for correlated groups was performed on the combined group where the gain scores of each pair of matched subjects (one from the experimental group and one from the control group) served as the correlation standard.

Table 8

t-Tests of Total Scores

EXPER.	MEAN	S.D%w.	t-VALUE	FREEDOM	2-TAIL PROB
Post	109.32	35.28			
Pre	93.14	36.16			
Diff	17.18	16.49	4.89	21	.000**
CONTROL	MEAN	S.DEV.	t-VALUE	FREEDOM	2-TAIL PROB
Post	100.45	38.15			
Pre	92.82	36.55			
Diff	7.64	12.68	2.83	21	.010*
DIFF (PRS)	MEAN	S.DEV.	t-VALUE	FREEDOM	2-TAIL PROB
Exper.	17.18	16.49			
Control	7.64	12.68			
Diff	9.55	19.33	2.32	21	.031*
DIFF (IND)	MEAN	S.DEV.	t-VALUE	FREEDOM	2-TAIL PROB
Exper.	17.18	16.49			
Control	7.64	12.68			
Pooled Variance			2.15	42	.037*

Legend: DIFF (PRS) = t-test by matched pairs method
DIFF (IND) = t-test by independent groups method
** = significant for P < .01
* = significant for P < .05

The criteria for determining significance is that the 2-tail probability must be below the alpha value of 0.05. The

2-tail probability value of 0.000 for the experimental group shows that the gain between pre and post test total scores was significant, and the 2-tail probability value of 0.019 for the control group indicates the gain scores of that group is also significant.

The research question asked: "Is the level of improvement in English language proficiency of students using VOXBOX as an instructional method equal to or higher than the level of improvement of students who use teacher-directed, non-computerized instructional methods, as measured by the Basic English Skills Test (BEST)?" The 2-tail probability of 0.037 for the t-test between groups (by the independent groups method, assuming pooled variance because the groups were matched, answers the research question in the affirmative, and significantly so.

The Pearson correlation coefficient, r, is a measure of the reliability of the test instrument and of the quality (correlation) of the pre and post test data (Pagano, 1986). In a control group/experimental group design, it is expected that the post-test results would improve after a process has been accomplished. The Pearson r, a number from 0 to 1, is a measure of the consistency of the results. The Pearson r for the experimental group total scores was 0.8937, and for the control group was 0.9433, indicating a high measure of correlation for each group.

So far the analysis has dealt with the results of the

experiment on a total-score basis, and has favorably answered the research question by showing that the experimental group gains exceed the gains achieved by the control group. Figure 2 graphs the individual oral score gains, Figure 3 shows the individual read score gains and Figure 4 displays the individual write score gains. In each graph, the starting points for pre-test averages are not the same for the experimental and control groups because the chosen method of analysis matches subjects on total scores and not individual scores.

Figure 2

Pre-test and Post-test Oral Scores and Gains

Figure 3

Pre-test and Post-test Read Scores and Gains

Figure 4

Pre-test and Post-test Write Scores and Gains

In all cases, the experimental group gain is greater than the control group gain. Table 9 summarizes the data for the separate BEST test scores and includes standard deviation, t-test and Pearson results.

Table 9

Oral, Read and Write Scores, Gains,
t-Test and Pearson Test Results

EXPERIMENTAL	ORAL	READ	WRITE
gain mean	10.41	4.18	2.59
gain sdev	12.07	8.63	5.54
t value	4.04	2.27	2.19
2-tail prob	0.001**	0.03*	0.04*
pearson	0.84	0.75	0.63
CONTROL	ORAL	READ	WRITE
gain mean	3.82	2.05	1.77
gain sdev	14.08	4.34	3.93
t value	1.27	2.21	2.12
2-tail prob	0.22	0.04*	0.05*
pearson	0.76	0.96	0.80
gain ratio	2.73	2.04	1.46

** = significant gain for P < .01
* = significant gain for P < .05

The oral gain improvement of the experimental group over the control group (gain ratio) is 10.41 divided by 3.82, a ratio of 2.73 (from Table 9). By similar calculations, the read gain improvement is 2.04, and the write gain improvement is 1.46. The only significant gain at alpha=.01 is the

experimental group's oral score, while both group's read scores and write scores achieved significance at alpha=.05.

The Pearson correlation coefficient, r, shows a high correlation of pre and post test scores.

Anecdotal Information

The research method of paired subjects on total score, and the calculated gains and statistics produced the indicated results. In addition to analysis of total scores, analyses of separate oral, read and write scores revealed similar gains, but the separate oral, read and write gains were based on subjects being matched on total score and not separate oral, read and write scores. In order to provide an equal basis of comparison, so that the oral, read and write gains could be analyzed in the same manner as the total gains, three additional methods of analysis were used. The first additional method paired the experimental group and control group subjects on pre-test oral scores and reported only the oral gains, The next method paired the subjects on read scores and reported only the read gains, and the last paired them on write scores, reporting only the write gains.

Table 10 compares the results of the main analysis method with the three additional methods pertaining to the oral, read and write gains. The oral and write gain improvements are nearly identical regardless of the method of analysis.

Table 10

Comparison of Oral, Read and Write Gain Ratios of Experimental Group Gain Over Control Group Gain by Method of Analysis

METHOD OF ANALYSIS	ORAL	READ	WRITE
Paired by Total Score	2.73	2.04	1.46
Paired by Oral Score	2.44		
Paired by Read Score		1.86	
Paired by Write Score			1.23

Chapter 5

CONCLUSIONS, DISCUSSION, AND SUGGESTIONS FOR FUTURE RESEARCH

This chapter summarizes the purpose and procedures of the study and presents conclusions based on the findings in Chapter 4. The conclusions are discussed and suggestions for improvement to VOXBOX are given followed by suggestions for further research.

Summary

The idea that computers can teach, that is, present material for learning, is not new. However, material to be presented had to be of a nature which could flourish in an environment that used only the eyes and the fingers since, until recently, that was the only interface available for a computer. This is not adequate for a language-learning environment, lacking the essential elements of using the mouth and the ear for speaking and listening. Additional materials have been developed using VOXBOX to see if a computer that was capable of making a student use his ears and mouth as well as his eyes and fingers could do a credible job of matching what a real teacher could do in teaching a subject, such as language, that required listening, speaking, reading and writing.

This study is an evaluation of VOXBOX, a computer-based

voice-interactive language learning system for teaching English as a second language. The VOXBOX equipment was installed in a refugee center in Oklahoma where recent immigrants to the United States from Mexico were seeking amnesty. (One requirement of being granted amnesty was that the immigrant be given English language training.) A criterion-referenced instrument designed specifically to measure the English language proficiency level of such immigrants, the Basic English Skills Test (BEST) was used to measure the English proficiency gains of the persons who participated in the program. Two groups were tested. The experimental group (N=26) used VOXBOX while the control group (N=45) received teacher-directed training using the same workbook materials that VOXBOX used.

A quantitative analysis was performed by selecting matched pairs (N=22 pairs), one subject from each group whose pre-test total scores (the sum of oral, read and write scores) were equal within 4% (the range of error of the BEST instrument).

Conclusions

The research question proposed by this study: "Is the level of improvement in English language proficiency of students using VOXBOX as an instructional method equal to or higher than the level of improvement of students who use teacher-directed, non-computerized instructional methods, as

measured by the Basic English Skills Test (BEST)?", is favorably answered by the research findings. It appears that the VOXBOX students improved their skills by a ratio of nearly 2.3 to 1 over the students who received teacher-directed training, and did it in less than two-thirds the hours of actual instruction, although taking a slightly longer calendar time to do it. Not only did the total scores improve dramatically, but each of the separate gains in oral, reading and writing improved as well, in all cases VOXBOX outperforming teacher-directed training.

It is concluded, therefore, that VOXBOX ought to be considered as a serious tool to augment or even replace teacher-directed training efforts in teaching English as a Second Language.

Discussion

The first item of discussion is the description, or profile, of the group of candidates who comprise the actual group of matched pairs in the study. Twenty-six (26) persons completed training on VOXBOX and their pre-test scores in oral comprehension, reading and writing skills were recorded separately. These three scores were then summed to provide a total score. The candidates and their total scores were then listed in order sorted by total score, from low score to high score. The same treatment was given to the forty-five (45) persons who completed the teacher-directed training.

The lists were then combined, and pairs of persons were then matched on the basis of total score. The profile of the resultant group of subjects was described in Chapter 4 by four criterion - gender, age, number of weeks between pre and post testing, and number of hours of training.

Both the experimental group (the VOXBOX group) and the control group (the group receiving teacher-directed training) were heavily male-populated. 64% of the experimental group were male, and 68% of the control group were male, so if there were any dominance of one gender over another, both groups had equal proportions, and gender could be ruled out as a confounding factor. The pairs were established on the basis of pre-test total scores without regard to gender. Of the pairs so matched, 45% were of different gender (one male, one female), and 55% of the pairs were of the same gender (either both males or both females). Again, the proportions being so close to 50%, the effect of pairing like-gendered candidates with unlike-gendered candidates would seem to nullify any significant effect of gender on the outcome of the experiment.

Considering the factor of age on the profile of the research group, the average age of the experimental group was 27.36 years compared to 30.41 years for the control group. There is no support in the literature that would allude to the idea that young adults, separated by only three years of age, would perform differently. Also, the difference in mean age between the groups is not justified as being significant due

to the large variance in the ages of either group, the experimental group ranging in age from 19 to 51 and the control group ranging in age from 22 to 42.

The number of weeks between pre and post testing for each group were nearly equal, if averages could be believed. The experimental group averaged 15 weeks between tests, while the control group averaged 13.04. However, a frequency distribution of the data shows a heavy concentration of weeks in the middle of the range for the control group, and more concentration on either end with a sparsity in the middle for the experimental group. This can be explained by the fact that the control group trained in a teacher-directed environment which was more time-scheduled than the VOXBOX environment. The heavy concentration for the control group was from 8 to 17 weeks, whereas the experimental group showed a considerable concentration in two ranges, 2 to 11 weeks, and 29 to 56 weeks. In the cases where the test period was short, students operating on their own schedule came in, trained, and exited. Where the test period was long, students arrived, trained for a while, experience a period of inactivity from training (mostly for job or family reasons) and then returned to complete the program.

The number of hours of training is another aspect of the profile which has a bearing on the interpretation of the results. The difference in means, 25.55 hours of training for the experimental group versus 44.73 hours for the control

group, is not as dramatically significant as it may appear. The variance of the means is quite large, with a range of 48 hours (from 8 to 56) for the experimental group, and a range of 65 hours (from 10 to 75 hours) for the control group. While the concentration of hours is from low to middle for the experimental group, and from middle to high for the control group, there is considerable overlap of data in the middle, between 24 and 56 hours, shared by both groups.

The difference in the hours of training may be explained by the Academic Learning Time theory expressed by Vockell and Schwartz (1988), which is described more fully in the literature review. The hours counted for the experimental group consisted totally of what Vockell and Schwartz call Engaged Time, the time actually spent in the learning process. The hours counted for the control group was Scheduled Time, an unknown portion of which was actual Engaged Time.

In addition, the training hours were recorded differently for each group. The training hours logged for students in the control group was determined by the teacher as roll was taken. In the case of the experimental group, VOXBOX recorded the actual engaged time of the student, from the time he booted up his disk to the time he terminated the session, and not the time he arrived and departed the premises.

Considering the fact that the subjects were matched on total pre-test scores, the gain in post-test total scores is quite dramatic. The VOXBOX group, left to their own devices

and motivated solely by their desire to complete their training, gained 17.2 points, or 10.1%, over their pre-test total scores. The control group, working under a teacher's direction, gained only 7.6 points, or 4.4%. Looking at those figures in terms of a ratio of gain, the VOXBOX group performed 2.26 times better than the teacher-directed group.

There are several factors which could explain this phenomenon. First, a human teacher (not to his discredit) does not always have the luxury of working one-on-one with the student as does VOXBOX. In a classroom situation, if the teacher says a word and asks the class to repeat, the teacher is not in a position to listen and correct each student's private utterance. Thus, the student does not get immediate feedback regarding the correctness or incorrectness of his attempts. VOXBOX, on the other hand, plays the role of the unrelenting taskmaster. The student hears a word spoken by a real voice which is stored in the computer, and is asked to repeat the word. The student is locked into this request, that is, he cannot quit or proceed further until he replies with the computer's request. The student responds by speaking into the computer's microphone, and his effort is recorded and saved by the computer. Then the computer repeats both the computer-stored voice and the student's effort side by side so that the student can hear the difference between the two. In this way, the student learns to speak by direct example.

Another factor relating to the above is that in a

classroom situation a student may be intimidated or embarrassed to speak in public because he is afraid his peers may ridicule his poor English. Working alone and in private with the VOXBOX computer, this problem is eliminated.

Learning a language involves not only speaking it, but reading and writing as well. Consider the aspects of reading and writing. In a teacher-directed environment, where the teacher has given a reading assignment to the class, the teacher does not know if the student has actually read the assigned material. If a student writes a response in a workbook, the teacher is not there to grade it immediately, nor would he be as unforgiving as the computer would be when it comes to judging errors. With VOXBOX, when a word is spoken to the student via earphones, that same word appears on the computer screen, and the student is asked to write it. If the student cannot read the word correctly, he cannot write it correctly, and VOXBOX will not allow the student to continue until he does write the word correctly.

Thus VOXBOX is successful because it combines the essential aspects of listening, speaking, reading, and writing in an environment that is not embarrassing or intimidating to the student; an environment that provides instant feedback to the student which is difficult to obtain in a teacher-directed situation.

While the results of the total score gains satisfy the query of the research question: "Is the level of improvement

in English language proficiency of students using VOXBOX as an instructional method equal to or higher than the level of improvement of students who use teacher-directed, non-computerized instructional methods, as measured by the Basic English Skills Test (BEST)?", other results of the experiment are equally important. Not only did the total scores improve, but each one of the individual scores of oral comprehension, and of reading and writing skills, showed an improvement of gain in VOXBOX's favor. The ratios of improvement of the VOXBOX method over teacher-directed methods was 2.73 for the oral scores, 2.04 for the read scores, and 1.46 for the write scores.

The implication of these results is that educators need to pay more attention to the capabilities of the speech-capable computer in language learning. The high cost of technical equipment (which is really not so high when balanced with the consideration of teachers' salaries) needs to be evaluated against the performance advantages which devices such as VOXBOX offer. It is not meant here to imply that teachers ought to be replaced by computers. Such is definitely not the case, as the human element is always needed. Consider how VOXBOX would be used in a normal situation. For purposes of this research, to eliminate as many confounding factors as possible, the VOXBOX students were denied access to a qualified language teacher. In normal use, however, every time the student speaks a word into the

microphone, that voice is recorded on disk and is available for a teacher's examination and feedback. Thus, VOXBOX becomes, not a replacement, but an extension of the teacher's capabilities. With VOXBOX doing a significant share of the 'rote' aspects of the language-learning methodology, the teacher can spend more quality time with students in a one-on-one situation.

Suggestions for Further Research

This experiment has great potential for further research, as the VOXBOX technology is now just at the forefront of the deluge of similar products which are certain to follow. Some of the conditions and limitations of this research for the purpose of projecting future ideas follow:

First, the subjects were all Mexican nationals whose native language was Spanish. The VOXBOX people have many testimonial letters from organizations who have used the TOEFL (Test Of English as a Foreign Language) as pre and post tests, and have used VOXBOX on subjects whose native language was primarily Chinese. The data from these groups were available, but could not be used because they were entirely experimental group data. There was no control group established for purposes of comparison. One organization conducted two experiments, one with young adults and another with teenage boys. From these examples spring many topics for future research. Would Chinese-speaking people learn better on

VOXBOX (or any similar computer system) than Spanish-speaking people? Tharp (1989) suggested there may be sharp differences in school achievements by members of different cultures. According to Tharp, one class of variables that varies by culture is motivation, and could be a factor in future research that deals with computer learning methods which are thought to be more self-motivational than teacher-based methods.

Other topics for research spring from the idea of considering cultural differences. Would young adults fare better than teenagers? Would there be a correlation between using the BEST and using the TOEFL as an instrument? It might also be desirable to have a large enough subject pool to compare the performance of males and females.

A major area of interest in the use of computers in language learning is the issue of real speech versus synthesized speech. Real speech must be pre-recorded and stored, requiring a considerable amount of space to do so. The voice messages so stored may be adequate for predictable responses such as might be used in drill-and-practice situations, but not for the spontaneity required for communications involving the techniques of using artificial intelligence. Computer-synthesized speech requires much less storage space, and messages can be generated by the computer on an as-needed basis, allowing the student to believe he is actually communicating with a person instead of talking to a

computer. An idea for future research would be to determine if synthesized speech can perform as well as real speech in serving as a model to help students communicate by listening and speaking in the target language.

One of the characteristics of the VOXBOX method of instruction was that students listened to a recorded voice and then was asked to repeat what he heard. VOXBOX then played back both the model voice and the student's voice for purposes of comparison. It was pointed out by Underwood (1984), however, that students may not be able to detect, merely by listening, any differences between their own voice and the model voice, thus they may not be able to correct their own efforts. There are devices on the market, such as Visi-Pitch, that produce a visible display of the model voice and the student's voice, so the student may see any differences even if he could not hear them. The problem with this approach is that students may not be able to interpret what they see, and thus require the services of a trained speech pathologist. A suggestion for future research would be to determine the effectiveness of these types of devices in language-learning applications.

Another area of research involves the general philosophy of computer use. The literature describes two differing philosophies, CAI (Computer-Aided-Instruction) and CALL (Computer-Assisted-Language-Learning). CAI is denoted by its drill and practice structure, while CALL is recognized by its

communicative approach where drill and practice take a back seat. Each method has its advantages and disadvantages, but generally, in a CAI system the computer is in control, whereas in CALL the student is in control. The question is, in which system does the most learning take place?

VOXBOX is classified as a drill and practice instrument. The developer's opinion is that CAI's drill and practice is necessary because of the nature of the typical low-level English-speaking-ability student who must be told in his own language what to do. It has been suggested that software be redesigned to accommodate the CALL philosophy, and let the purchaser of the equipment decide, either permanently or on an ad hoc basis, which method is best for him. The main difference would be that the student, instead of being forced to complete a prescribed routine, would have the option of typing or not typing a word, or speaking or not speaking into the microphone. It would be an important research study to take such a system and conduct an experiment where the experimental group uses the VOXBOX equipment in a CALL configuration and the control group uses the VOXBOX in its present CAI configuration. Would a student learn more, or be more willing to learn, if he had more control of the computer instead of the computer being in control?

On the subject of improvements or changes in operating philosophy to VOXBOX, the issue of speed needs to be addressed. If any criticism of VOXBOX could be made, it is

that it takes too long for screens to update and, generally, for the computer to respond to the student's input. The student management system, the part of the program that teachers use to query the progress of students, is slow and complicated. The blame, however, is not due to VOXBOX's negligence but to limitations in technology. The fast computers are just becoming a reality, but at this point few school systems or educational facilities such as refugee centers that depend on public money can afford them.

To assist further research efforts, the complete source code listing for the computer program that analyzed the data for this research project is found in Appendix B, TFL-BEST PROGRAM SOURCE CODE. This program, called TFL-BEST, was written in Microsoft Professional BASIC version 7.0. It allows input of real and/or simulated data, and produces the resulting output found in Appendix A, TFL-BEST AND SPSS PROGRAM OUTPUT. It also creates all of the necessary 'include' and data files for analysis by SPSS statistical software (Norusis, 1988). The output calculations produced by the SPSS program are also found in Appendix A, following the TFL-BEST program output. The TFL-BEST program is designed to accommodate both BEST and TOEFL scores, and will consider all cases in any particular data set, or cases from within the data set selected by gender, national origin, or native language.

REFERENCES CITED

REFERENCES CITED

Alderson, J. Charles; Krahnke, Karl J.; and Stansfield, Charles W., eds. 1987. Reviews of English Language Proficiency Tests. Washington, D.C.: TESOL.

Andelin, John. 1987. Trends and Status of Computers in Schools: Use in Chapter I Programs and Use With Limited English Proficient Students. Washington, DC: Office of Technology Assessment, U.S. Congress.

Arcell, Paul. 1990. Telephone interview, 13 January.

Benson, Malcolm J. 1989. "The Academic Listening Task: A Case Study." TESOL Quarterly 23, no. 3, pp. 421-445.

Best, John W. 1977. Research in Education. Englewood Cliffs, New Jersey: Prentice-Hall.

Brooks, Nelson. 1964. Language and Language Learning. New York: Harcourt, Brace and World.

Carroll, John B. 1971. "Development of Native Language Skills Beyond the Early Years". In The Learning of Language. New York: Appleton-Century-Crofts.

Clark, J. L. D.; and Grognet, A. G. 1985. "Development and Validation of a Performance-based Test of ESL Survival Skills." In Second Language Performance Testing. Ottawa: University of Ottawa.

Dunn, R. S. 1983. "Learning Style and its Relation to Exceptionality at Both Ends of the Spectrum." Exceptional Children 49: 496-506.

Erickson, Richard C.; and Wentling, Tim L. 1976. Measuring Student Growth. Boston: Allyn and Bacon.

Frommer, Judith. 1989. "Listening, Looking, and Learning with MacLang." CALICO Journal 6, no. 4, pp. 51-71.

Handbook for Teaching Japanese-Speaking Students. 1987. Sacramento: California State Department of Education.

Hannafin, Michael J.; and Peck, Kyle L. 1988. The Design, Development, and Evaluation of Instructional Software. New York: Macmillan.

Hartung, Kerran. 1989. Personal interview, Vista, California, 15 November.

Hawkins, William J. 1989. "Instant Spoken Translation." Popular Science 234, no 5, pp. 78-82.

Hope, Geoffrey R.; Taylor, Heimy F.; and Pusack, James P. 1984. Using Computers in Teaching Foreign Languages. Orlando: Harcourt-Brace-Jovanovich.

Hughes, Arthur. 1982. "The Structure of Language Proficiency." In Linguistic Controversies. Baltimore: University Park Press.

Keefe, J. W. 1979. Student Learning Styles: Diagnosing and Prescribing Programs. Reston, VA: National Association of Secondary School Principals.

Knutsen, K. Eric; and Nolan, Richard L. 1974. "Assessing Computer Costs and Benefits." Journal of Systems Management 25, no. 2, pp. 28-34.

Lado, Robert. 1961. Language Testing. London: Longmans, Green.

MacDonald, Marguerite G. 1989. "Oral Dialogue Journals: Spoken Language in a Communicative Context." TESOL Reporter 22, no. 2, pp. 27-31.

Norusis, Marija J. 1988. SPSS/PC+ Studentware. Chicago: SPSS, Inc.

_____ 1988. The SPSS Guide to Data Analysis. Chicago: SPSS, Inc.

Oliva, Peter F. 1969. The Teaching of Foreign Languages. Englewood Cliffs, New Jersey: Prentice-Hall.

Oller, J. W. 1979. Language Tests at School. London: Longman.

Pack, Alice C. 1989. Personal interview, Vista, California, 23 May.

Pagano, Robert R. 1986. Understanding Statistics in the Behavioral Sciences. St. Paul: West.

Pappert, Seymour. 1980. Mindstorms: Children, Computers, and Powerful Ideas. New York: Basic Books.

Parker, Richard E.; and Davis, Robert C. 1989. "Digital Audio, Networks, and Foreign Language Instruction." CALICO Journal 7, no. 2, pp. 71-82.

Salazar, Jorge. 1989. "Interactive Audio Strategies for Developing Listening Skills." CALICO Journal 7, no. 1, pp. 67-75.

"Spang-Robinson Report on Artificial Intelligence." 1989. High Technology Business 9, no. 9, p. 36.

Stevenson, Douglas K. 1987. "Test of English as a Foreign Language." In Reviews of English Language Proficiency Tests. Washington, DC: TESOL.

Tharp, Roland G. 1989. "Psychocultural Variables and Constants." American Psychologist 44, no.2, pp. 349-359.

Torrey, Jane W. 1971. "Second Language Learning." In The Learning of Language. New York: Appleton-Century-Crofts.

Underwood, John. 1984. Linguistics, Computers and the Language Teacher: A Communicative Approach. Rowley, Mass: Newbury House.

Vockell, Edward; and Schwartz, Eileen. 1988. The Computer In The Classroom. Santa Cruz, CA: Mitchell Publishing, Inc.

"Voice Recognition Becomes Feasible." 1989. High Technology Business 9, no. 9, p. 38.

REFERENCES CONSULTED

REFERENCES CONSULTED

Blair, Robert. 1982. Innovative Approaches to Language Teaching. Rowley, Massachusetts: Newbury House.

Bork, A. 1984. "Education and Computers: The Situation Today and Some Possible Futures." T.H.E. Journal 12, no. 3, pp. 92-97.

Bright, G. W. 1983. "Explaining the Efficiency of Computer-Assisted Instruction." AEDS Journal 16, no. 3, pp. 144-153.

Bunderson, C. Victor. 1981. "Chapter Four: Courseware." In Computer-Based Instruction: A State-of-the-Art Assessment. New York: Academic Press.

Carroll, B. J. 1980. Testing Communicative Performance. Oxford: Pergamon.

Carroll, B. J.; and Hall, P. J. 1985. Make Your Own Language Tests: A Practical Guide to Writing Language Performance Tests. Oxford: Pergamon.

Chapelle, Carol; and Jamieson, Joan. 1986. "Computer-Assisted Language Learning as a Predictor of Success in Acquiring English as a Second Language." TESOL Quarterly 20, no. 1, pp. 27-46.

Cohen, A. D. 1980. Testing Language Ability in the Classroom. Rowley, MA: Newbury House.

Dence, M. 1980. "Toward Defining the Role of CAI: A Review." Educational Technology 20, no. 11, pp. 50-54.

Dunkel, Patricia. 1987. "The Effectiveness Literature on CAI/CALL and Computing: Implications of the Research for Limited English Proficient Learners." TESOL Quarterly 21, no. 2, pp. 367-372.

Fisher, G. 1983. "Where CAI is Effective: A Summary of the Research." Electronic Learning 3, pp. 82, 84.

Grady, M. Tim. 1983. "Software Evaluation Criteria." In Computers in Curriculum and Instruction. Assn. for Supervision and Curriculum Development (ASCD).

Krashen, Stephen D. 1982. Principles and Practice in Second Language Acquisition. Oxford: Pergamon Press.

Kulick, J. A.; and Kulick, C. C. 1986. "Effectiveness of Computer-based Education in Colleges." AEDS Journal 19, pp. 81-108.

Kulick, J. A.; Kulick, C. C.; and Bangert-Drowns, L. 1985. "Effectiveness of Computer-based Education in Elementary Schools." Computers in Human Behavior 1, pp. 59-74.

Light, R. L.; Xu, Ming; and Mossop, J. 1987. "English Proficiency and Academic Performance of International Students." TESOL Quarterly 21, no. 2, pp. 251-261.

Madsen, H. 1979. "An Indirect Measure of Listening Comprehension." Modern Language Journal 63, pp. 429-435.

Molholt, Garry. 1988. "Computer-Assisted Instruction in Pronunciation for Chinese Speakers of American English." TESOL Quarterly 22, no. 1, pp. 91-111.

Orlansky, J. 1983. "Effectiveness of CAI: A Different Finding." Electronic Learning 3, pp. 58-60.

Pack, Alice C.; and Petersen, Martin J., Jr. 1987. Word Works, the Computer Program. San Diego: United States International University.

Petersen, Martin J., Jr. 1989. SPLASH, the Computer Program. San Diego: United States International University.

Politzer, R. L.; and McGrarty, Mary. 1985. "An Exploratory Study of Learning Behaviors and Their Relationship to Gains in Linguistic and Communicative Competence." TESOL Quarterly 19, no. 1, pp. 103-123.

Reid, Joy, M. 1987. "The Learning Style Preferences of ESL Students." TESOL Quarterly 21, no. 1, pp. 87-111.

Sansom, Robert. 1988. "A Criterion-Referenced Evaluation of the Computer-Assisted Program WORDWORKS in the Learning of College Level ESL." Ed. D. dissertation, United States International University, San Diego.

Stevens, Vance. 1988. "Current Research in the Effectiveness of CALL." C.A.L.L. Digest 4, no. 3, p. 9.

Terrell, Tracy D. 1977. "A Natural Approach to Second Language Learning." Modern Language Journal 61, pp. 325-326.

Wigdor, A. K.; and Garner, W. R., eds. 1982. Ability Testing: Uses, Consequences, and Controversies (Part II). Washington, D.C.: National Academy.

APPENDICES

Appendix A.....*TFL-BEST* AND *SPSS* PROGRAM OUTPUT

Appendix B.....*TFL-BEST* PROGRAM SOURCE CODE

Appendix C.....INFORMATION ON VOXBOX

APPENDIX A

TFL-BEST AND *SPSS* PROGRAM OUTPUT

APPENDIX A

TFL-BEST AND *SPSS* PROGRAM OUTPUT

The *TFL-BEST* program prints a listing of the experimental group, the control group, and the statistical calculations, and produces the 'include' files necessary for the *SPSS* program, which verifies the calculations.

BEST: _TOTAL CASES: ALL EXPERIMENTAL

-----SUBJECT-----					-----PRE-TEST----				time		----POST-TEST----				--GAIN--
ID	S	CNT	LNG	AGE	O	R	W	TOT	WK	HR	O	R	W	TOT	TOT
147	M	743	478	32	26	5	1	32	11	22	31	9	5	45	13
103	M	743	478	23	24	7	13	44	11	34	54	7	14	75	31
114	F	743	478	32	14	16	14	44	2	40	20	11	9	40	-4
104	M	743	478	25	45	7	4	56	11	18	53	7	10	70	14
105	M	743	478	23	56	1	3	60	6	18	64	29	15	108	48
106	M	743	478	21	48	10	4	62	29	26	75	28	15	118	56
107	M	743	478	25	54	8	3	65	8	18	53	12	10	75	10
144	M	743	478	25	30	29	16	75	14	18	74	25	18	117	42
140	M	743	478	25	50	14	11	75	4	16	75	12	11	98	23
115	M	743	478	28	43	18	17	78	7	14	51	20	17	88	10
121	F	743	478	19	42	23	16	81	11	12	60	27	10	97	16
110	M	743	478	19	53	23	15	91	11	24	68	27	10	105	14
102	M	743	478	19	63	20	16	99	30	30	73	30	14	117	18
143	M	743	478	24	51	38	16	105	8	30	53	22	15	90	-15
120	F	743	478	32	66	31	15	112	8	30	65	32	15	112	0
138	M	743	478	36	88	30	6	124	11	40	89	35	22	146	22
127	F	743	478	43	74	32	20	126	18	36	86	43	25	154	28
112	M	743	478	25	78	32	19	129	5	24	78	40	18	136	7
123	M	743	478	25	89	30	16	135	13	8	85	40	20	145	10
145	M	743	478	24	78	36	24	138	56	20	91	42	25	158	20
136	F	743	478	51	89	35	23	147	38	56	88	40	27	155	8
135	M	743	478	26	87	43	19	149	18	28	91	42	23	156	7
22 cases				27	57	22	13	92	15	26	67	26	16	109	17.2

Explanation of column headings and symbols:

ID = case number of subject
S = sex of subject
CNT = native country code of subject
LNG = native language code of subject
AGE = age of subject at time of pre-test
O = oral (core) score
R = read score
W = write score
TOT = sum of oral, read, and write scores
WK = time in weeks between tests
HR = number of hours of instruction

BEST: _TOTAL CASES: ALL CONTROL

-----SUBJECT-----					-----PRE-TEST----				time		----POST-TEST----				--GAIN--
ID	S	CNT	LNG	AGE	O	R	W	TOT	WK	HR	O	R	W	TOT	TOT
201	M	743	478	36	20	8	7	35	9	48	22	8	9	39	4
232	F	743	478	32	10	12	16	38	17	68	25	21	17	63	25
214	M	743	478	42	41	1	8	50	17	70	40	1	9	50	0
236	F	743	478	23	29	14	12	55	12	40	18	18	16	52	-3
217	M	743	478	26	31	15	11	57	17	48	43	18	19	80	23
206	M	743	478	31	41	12	8	61	8	53	32	20	16	68	7
212	M	743	478	40	48	5	9	62	10	40	5	14	16	35	-27
243	F	743	478	34	41	18	17	76	24	65	55	18	14	87	11
242	F	743	478	27	32	27	16	75	13	45	54	22	20	96	21
211	M	743	478	30	45	23	13	81	12	63	49	28	15	92	11
209	F	743	478	27	33	32	18	83	8	38	47	34	15	96	13
207	M	743	478	32	41	31	19	91	13	10	41	32	18	91	0
218	M	743	478	29	61	20	19	100	14	68	64	24	17	105	5
222	M	743	478	26	65	29	17	111	9	33	76	41	19	136	25
227	M	743	478	33	48	45	22	115	16	45	66	46	21	133	18
208	M	743	478	29	54	46	25	125	10	25	67	45	23	135	10
202	M	743	478	33	63	43	22	128	19	38	74	44	21	139	11
238	F	743	478	28	71	43	19	133	8	18	79	40	25	144	11
220	M	743	478	29	70	43	21	134	9	38	80	43	29	152	18
229	F	743	478	34	71	43	25	139	16	23	56	42	29	127	-12
228	M	743	478	22	71	45	29	145	11	35	71	43	24	138	-7
223	M	743	478	26	72	47	29	148	15	73	78	45	29	152	4
22 cases				30	48	27	17	93	13	45	52	29	19	100	7.6

Explanation of column headings and symbols:

ID = case number of subject
S = sex of subject
CNT = native country code of subject
LNG = native language code of subject
AGE = age of subject at time of pre-test
O = oral (core) score
R = read score
W = write score
TOT = sum of oral, read, and write scores
WK = time in weeks between tests
HR = number of hours of instruction
? = missing age, weeks or hours data

BEST: _TOTAL CASES: ALL COMBINED

-----SUBJECT-----				-----PRE-TEST----				time		----POST-TEST----				--GAIN--
ID	S	CNT	LNG	AGE	O	R	W	TOT	WK	HR	O	R	W	TOT	TOT
44 cases				29	52	25	15	92	14	35	60	28	17	105	12.4

	ORAL		READ		WRITE		TOTAL	
	GAIN	PCT	GAIN	PCT	GAIN	PCT	GAIN	PCT
EXPERIMENTAL	10.4	11.2	4.2	8.5	2.6	8.9	17.2	10.0
CONTROL	3.8	4.1	2.0	4.2	1.8	6.1	7.6	4.5
COMBINED	7.1	7.6	3.1	6.4	2.2	7.5	12.4	7.3

EXPERIMENTAL:	ORAL	READ	WRITE	TOTAL
gain mean:	10.4091	4.1818	2.5909	17.1818
gain sdev:	12.0738	8.6335	5.5434	16.4914
t (cor):	4.0437	2.2719	2.1922	4.8868
p (2-tail):	0.0010*	0.0369+	0.0423+	0.0010*
pearson:	0.8431	0.7545	0.6288	0.8937

CONTROL:	ORAL	READ	WRITE	TOTAL
gain mean:	3.8182	2.0455	1.7727	7.6364
gain sdev:	14.0835	4.3367	3.9271	12.6775
t (cor):	1.2716	2.2123	2.1173	2.8253
p (2-tail):	0.2311	0.0409+	0.0474+	0.0102+
pearson:	0.7662	0.9613	0.8022	0.9433

COMBINED:	ORAL	READ	WRITE	TOTAL
gain mean:	7.1136	3.1136	2.1818	12.4091
gain sdev:	13.3855	6.8377	4.7655	15.3173
t (cor):	3.5252	3.0205	3.0369	5.3738
p (2-tail):	0.0022*	0.0073*	0.0071*	0.0010*

Explanation of symbols:

* = 2-tail results are significant at alpha = .01
\+ = 2-tail results are significant at alpha = .05

```
include '_total.inc'.
DATA list file = '_TOTAL.BST' /
ID 1-3 GENDER 5-5 BDATE 7-12 CNT 14-16 LNG 18-20 GROUP 22-22 EDATE 24-29
E1 31-32 E2 34-35 E3 37-38 ODATE 40-45 O1 47-48 O2 50-51 O3 53-54
HRS 56-57 SEL 59-59.

include 'TFL-BEST.INC'.
variable labels /
  BDATE "BIRTHDATE"
  CNT "COUNTRY"
  LNG "LANGUAGE"
  EDATE "PRE-TEST DATE"
  ODATE "POST-TEST DATE".

value labels  /
  GENDER  1  'MALE'
          2  'FEMALE' /
  GROUP   1  'EXPERIMENTAL'
          2  'CONTROL'.

missing value /
  GENDER, GROUP (9).

include 'BEST.INC'.
select if (sel=1).
variable labels e1 'VOXBOX group PRE-test ORAL'.
variable labels e2 'VOXBOX group PRE-test READ'.
variable labels e3 'VOXBOX group PRE-test WRITE'.
variable labels o1 'VOXBOX group POST-test ORAL'.
variable labels o2 'VOXBOX group POST-test READ'.
variable labels o3 'VOXBOX group POST-test WRITE'.
```

```
process if (group=1).
t-test pairs = o1 with e1.
The raw data or transformation pass is proceeding
     44 cases are written to the compressed active file.
```

Paired samples t-test: O1 VOXBOX group POST-test ORAL

E1 VOXBOX group PRE-test ORAL

Variable	Number of Cases	Mean	Standard Deviation	Standard Error
O1	22	67.1364	19.119	4.076
E1	22	56.7273	22.446	4.786

(Difference) Mean	Standard Deviation	Standard Error	2-Tail Corr.	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.
10.4091	12.074	2.574	.843	.000	4.04	21	.001

This procedure was completed at 14:20:08

```
process if (group=1).
t-test pairs = o2 with e2.
```

Paired samples t-test: O2 VOXBOX group POST-test READ

E2 VOXBOX group PRE-test READ

Variable	Number of Cases	Mean	Standard Deviation	Standard Error
O2	22	26.3636	12.373	2.638
E2	22	22.1818	12.269	2.616

(Difference) Mean	Standard Deviation	Standard Error	2-Tail Corr.	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.
4.1818	8.633	1.841	.755	.000	2.27	21	.034

This procedure was completed at 14:20:13

```
process if (group=1).
t-test pairs = o3 with e3.

Paired samples t-test:  O3        VOXBOX group POST-test WRITE
                        E3        VOXBOX group PRE-test WRITE

Variable      Number of Cases      Mean    Standard Deviation    Standard Error

O3                 22            15.8182        5.949              1.268
E3                 22            13.2273        6.796              1.449

(Difference) Mean | Standard Deviation | Standard Error | 2-Tail Corr. | 2-Tail Prob. | t Value | Degrees of Freedom | 2-Tail Prob.

    2.5909        5.543            1.182          .629          .002          2.19          21              .040

This procedure was completed at 14:20:18

process if (group=1).
compute var1 = e1+e2+e3.
process if (group=1).
compute var2 = o1+o2+o3.
variable labels var1 'VOXBOX group PRE-test TOTAL'.
variable labels var2 'VOXBOX group POST-test TOTAL'.
process if (group=1).
t-test pairs = var2 with var1.
The raw data or transformation pass is proceeding
     44 cases are written to the compressed active file.

Paired samples t-test:  VAR2      VOXBOX group POST-test TOTAL
                        VAR1      VOXBOX group PRE-test TOTAL

Variable      Number of Cases      Mean    Standard Deviation    Standard Error

VAR2               22           109.3182       35.278             7.521
VAR1               22            92.1364       36.160             7.709

(Difference) Mean | Standard Deviation | Standard Error | 2-Tail Corr. | 2-Tail Prob. | t Value | Degrees of Freedom | 2-Tail Prob.

   17.1818       16.491           3.516          .894          .000          4.89          21              .000

This procedure was completed at 14:20:38
```

```
variable labels e1 'CONTROL group PRE-test ORAL'.
variable labels e2 'CONTROL group PRE-test READ'.
variable labels e3 'CONTROL group PRE-test WRITE'.
variable labels o1 'CONTROL group POST-test ORAL'.
variable labels o2 'CONTROL group POST-test READ'.
variable labels o3 'CONTROL group POST-test WRITE'.

process if (group=2).
t-test pairs = o1 with e1.

Paired samples t-test:  O1        CONTROL group POST-test ORAL
                        E1        CONTROL group PRE-test ORAL

Variable     Number                  Standard    Standard
             of Cases      Mean      Deviation     Error

O1             22        51.9091      21.798      4.647
E1             22        48.0909      18.166      3.873

(Difference)  Standard   Standard  |     2-Tail    |   t    Degrees of   2-Tail
     Mean     Deviation    Error   |  Corr.  Prob. |  Value   Freedom     Prob.

   3.8182      14.084     3.003    |   .766   .000  |  1.27      21        .217

This procedure was completed at 14:20:45

process if (group=2).
t-test pairs = o2 with e2.

Paired samples t-test:  O2        CONTROL group POST-test READ
                        E2        CONTROL group PRE-test READ

Variable     Number                  Standard    Standard
             of Cases      Mean      Deviation     Error

O2             22        29.4091      13.654      2.911
E2             22        27.3636      15.283      3.258

(Difference)  Standard   Standard  |     2-Tail    |   t    Degrees of   2-Tail
     Mean     Deviation    Error   |  Corr.  Prob. |  Value   Freedom     Prob.

   2.0455       4.337      .925    |   .961   .000  |  2.21      21        .038

This procedure was completed at 14:20:51
```

```
process if (group=2).
t-test pairs = o3 with e3.
```

Paired samples t-test: O3 CONTROL group POST-test WRITE
E3 CONTROL group PRE-test WRITE

Variable	Number of Cases	Mean	Standard Deviation	Standard Error
O3	22	19.1364	5.685	1.212
E3	22	17.3636	6.536	1.393

(Difference) Mean	Standard Deviation	Standard Error	2-Tail Corr.	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.
1.7727	3.927	.837	.802	.000	2.12	21	.046

This procedure was completed at 14:20:56

```
process if (group=2).
compute var1 = e1+e2+e3.
process if (group=2).
compute var2 = o1+o2+o3.
variable labels var1 'CONTROL group PRE-test TOTAL'.
variable labels var2 'CONTROL group POST-test TOTAL'.
process if (group=2).
t-test pairs = var2 with var1.
The raw data or transformation pass is proceeding
     44 cases are written to the compressed active file.
```

Paired samples t-test: VAR2 CONTROL group POST-test TOTAL
VAR1 CONTROL group PRE-test TOTAL

Variable	Number of Cases	Mean	Standard Deviation	Standard Error
VAR2	22	100.4545	38.146	8.133
VAR1	22	92.8182	36.551	7.793

(Difference) Mean	Standard Deviation	Standard Error	2-Tail Corr.	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.
7.6364	12.677	2.703	.943	.000	2.83	21	.010

This procedure was completed at 14:21:16

```
compute var1 = o1-e1.
compute var2 = o2-e2.
compute var3 = o3-e3.
compute var4 = o1+o2+o3-e1-e2-e3.
variable labels var1 'VOXBOX/CONTROL ORAL gain'.
variable labels var2 'VOXBOX/CONTROL READ gain'.
variable labels var3 'VOXBOX/CONTROL WRITE gain'.
variable labels var4 'VOXBOX/CONTROL TOTAL gain'.
t-test groups = group(1,2) / var = var1.
The raw data or transformation pass is proceeding
     44 cases are written to the compressed active file.

Independent samples of  GROUP

Group 1:  GROUP  EQ 1          Group 2:  GROUP  EQ 2

t-test for:  VAR1      VOXBOX/CONTROL ORAL gain

                 Number                    Standard    Standard
                of Cases      Mean        Deviation     Error

      Group 1       22      10.4091         12.074      2.574
      Group 2       22       3.8182         14.084      3.003

                |  Pooled Variance Estimate  |  Separate Variance Estimate
                |                            |
   F    2-Tail  |    t   Degrees of  2-Tail  |    t    Degrees of  2-Tail
  Value  Prob.  |  Value   Freedom    Prob.  |  Value    Freedom     Prob.
                |                            |
  1.36   .486   |  1.67      42       .103   |  1.67     41.04       .103

This procedure was completed at 14:21:38

t-test groups = group(1,2) / var = var2.

Independent samples of  GROUP

Group 1:  GROUP  EQ 1          Group 2:  GROUP  EQ 2

t-test for:  VAR2      VOXBOX/CONTROL READ gain

                 Number                    Standard    Standard
                of Cases      Mean        Deviation     Error

      Group 1       22       4.1818          8.633      1.841
      Group 2       22       2.0455          4.337       .925

                |  Pooled Variance Estimate  |  Separate Variance Estimate
                |                            |
   F    2-Tail  |    t   Degrees of  2-Tail  |    t    Degrees of  2-Tail
  Value  Prob.  |  Value   Freedom    Prob.  |  Value    Freedom     Prob.
                |                            |
  3.96   .003   |  1.04      42       .306   |  1.04     30.96       .308
```

This procedure was completed at 14:35:26

t-test groups = group(1,2) / var = var3.

Independent samples of GROUP

Group 1: GROUP EQ 1 Group 2: GROUP EQ 2

t-test for: VAR3 VOXBOX/CONTROL WRITE gain

	Number of Cases	Mean	Standard Deviation	Standard Error
Group 1	22	2.5909	5.543	1.182
Group 2	22	1.7727	3.927	.837

		Pooled Variance Estimate			Separate Variance Estimate		
F Value	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.
1.99	.122	.56	42	.575	.56	37.84	.575

This procedure was completed at 14:35:33

t-test groups = group(1,2) / var = var4.

Independent samples of GROUP

Group 1: GROUP EQ 1 Group 2: GROUP EQ 2

t-test for: VAR4 VOXBOX/CONTROL TOTAL gain

	Number of Cases	Mean	Standard Deviation	Standard Error
Group 1	22	17.1818	16.491	3.516
Group 2	22	7.6364	12.677	2.703

		Pooled Variance Estimate			Separate Variance Estimate		
F Value	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.	t Value	Degrees of Freedom	2-Tail Prob.
1.69	.236	2.15	42	.037	2.15	39.40	.038

This procedure was completed at 14:35:41

fin

APPENDIX B

TFL-BEST PROGRAM SOURCE CODE

APPENDIX B

TFL-BEST PROGRAM SOURCE CODE

Appendix B lists the source code for the *TFL-BEST* program, written in Microsoft Professional BASIC, version 7.0. The *TFL-BEST* program analyzes the experimental group/control group data, calculates the statistics, produces bar graphs of gains, and creates the necessary `include' files for the *SPSS* program which verifies the statistical calculations.

```
'TFL-BEST - analyzes TOEFL or BEST test data and produces statistics.

'copyright 1990 Martin J. Petersen, Jr.

'the IBM-compatible executable code for this program is available from
'Intechnica International, Inc., Midwest City, Oklahoma.

'takes ascii text data in the form:
'id,sex,bdate,ntv.ctry,ntv.lng,group,edate,e1,e2,e3,odate,o1,o2,o3,hours
,sel

'       id: any number (all data in this file must be numeric)
'      sex: 1=male, 2=female
'    bdate: birthdate, a number in the form yymmdd (omit the "19")
'  country: a number from the TOEFL admissions form (use the same for '
          BEST)
' language: a number from the TOEFL admissions form (use the same for '
          BEST)
'    group: 1=experimental, 2=control
'    edate: pre-test date, a number in the form yymmdd (omit the "19")
'       e1: pre-test TOEFL listening score, a number from 20 to 68,  or
'           pre-test BEST oral score, a number from 1 to 93
'       e2: pre-test TOEFL structure score, a number from 20 to 68, or
'           pre-test BEST read score, a number from 1 to 49
'       e3: pre-test TOEFL vocabulary score, a number from 20 to 67, or
'           pre-test BEST write score, a number from 1 to 29
'    odate: post-test date, a number in the form yymmdd (omit the "19")
'       o1: post-test counterpart of e1
'       o2: post-test counterpart of e2
'       o3: post-test counterpart of e3
'    hours: number of hours of instruction
'   select: 1=selected, 0 = not selected

'data file was designed to be compatible with SPSS statistics software
'data files of unlimited length, to be used with this program,
'may be created with any text editor
'or with SPEED-IT from The Computer Solution, Vista CA
```

```
'example of one record to show column positions:

'001 1 720712 319 315 1 891015 25 27 29 900215 34 36 38 57 1

' variable    width    column positions
' --------    -----    ----------------
'      ID        3        1 -  3
'     SEX        1        5 -  5
'   BDATE        6        7 - 12
'     CNT        3       14 - 16
'     LNG        3       18 - 20
'   GROUP        1       22 - 22
'   EDATE        6       24 - 29
'      E1        2       31 - 32
'      E2        2       34 - 35
'      E3        2       37 - 38
'   ODATE        6       40 - 45
'      O1        2       47 - 48
'      O2        2       50 - 51
'      O3        2       53 - 54
'   HOURS        2       56 - 57
'     SEL        1       59 - 59

DECLARE FUNCTION mean! (num!, den!)
DECLARE FUNCTION sdev! (x!, x2!, n!)
DECLARE FUNCTION tpairs! (x!, x2!, n!)
DECLARE FUNCTION tindgrp (sumx1, sum2x1, n1, sumx2, sum2x2, n2)
DECLARE FUNCTION t2tail! (t!, df!, dt!())
DECLARE FUNCTION pearson (o, e, oe, O2, E2, n)

revdate$ = "6/5/90"
test$ = "T": title$ = "TOEFL/BEST TEST ANALYZER"
IF INSTR(COMMAND$, "/T") > 0 THEN test$ = "T": title$ = "TOEFL TEST
                                                  ANALYZER"
IF INSTR(COMMAND$, "/B") > 0 THEN test$ = "B": title$ = "BEST TEST
                                                  ANALYZER"

' table D for t-test significance
DIM dt(7, 30)
FOR B = 1 TO 7
  FOR a = 1 TO 30
    READ dt(B, a)
  NEXT a
NEXT B
DATA 3.078,1.886,1.638,1.633,1.476,1.440,1.415,1.397,1.383,1.372
DATA 1.363,1.356,1.350,1.345,1.341,1.337,1.333,1.330,1.328,1.325
DATA 1.323,1.321,1.319,1.318,1.316,1.315,1.314,1.313,1.311,1.310
DATA 6.314,2.920,2.353,2.132,2.015,1.943,1.895,1.860,1.833,1.812
DATA 1.796,1.782,1.771,1.761,1.753,1.746,1.740,1.734,1.729,1.725
DATA 1.721,1.717,1.714,1.711,1.708,1.706,1.703,1.701,1.699,1.697
DATA 12.706,4.303,3.182,2.776,2.571,2.447,2.365,2.306,2.262,2.228
DATA 2.201,2.179,2.160,2.145,2.131,2.120,2.110,2.101,2.093,2.086
DATA 2.080,2.074,2.069,2.064,2.060,2.056,2.052,2.048,2.045,2.042
DATA 31.821,6.965,4.541,3.747,3.365,3.143,2.998,2.896,2.821,2.764
DATA 2.718,2.681,2.650,2.624,2.604,2.483,2.567,2.552,2.539,2.528
DATA 2.518,2.508,2.500,2.492,2.485,2.479,2.473,2.467,2.462,2.457
DATA 63.657,9.925,5.841,4.604,4.032,3.707,3.499,3.355,3.250,3.169
DATA 3.106,3.055,3.012,2.977,2.947,2.921,2.898,2.878,2.861,2.845
DATA 2.831,2.819,2.807,2.797,2.787,2.779,2.771,2.763,2.756,2.750
DATA 636.619,31.598,12.941,8.610,6.859,5.959,5.405,5.041,4.781,4.587
DATA 4.437,4.318,4.221,4.140,4.073,4.015,3.965,3.922,3.883,3.850
DATA 3.819,3.792,3.767,3.745,3.725,3.707,3.690,3.674,3.659,3.646
```

```
DATA 99,99,99,99,99,99,99,99,99,99,99,99,99,99,99
DATA 99,99,99,99,99,99,99,99,99,99,99,99,99,99,99

FOR a = 1 TO 3
  READ g$(a)
NEXT a
DATA "EXPERIMENTAL","     CONTROL","    COMBINED"

'data for perpetual calendar
DIM m(12)
FOR a = 1 TO 12
  READ m(a)
NEXT a
DATA 0,31,59,90,120,151,181,212,243,273,304,334

DIM stats(3, 5, 5): 'groups, sections,stat
DIM lsv(3, 6): 'groups, gains
DIM aw(3, 3, 2)
'groups, 1=age 2=weeks 3=hours, 0=missing data 1=total 2=count
DIM sbj(15)
m = 5: 'margin

logo:
WIDTH "scrn:", 40
nf = 15: nb = 1: hb = 4
td = .02
ew$ = "*****   THE COMPUTER SOLUTION   *****"
bw$ = "****  PRESS ANY KEY TO CONTINUE  ****"
ON ERROR GOTO grapherr
SCREEN 1
th = 0

endgrapherr:
ON ERROR GOTO unknownerr
SCREEN 0
KEY OFF
CLS
COLOR nb, nf
FOR i = 2 TO 24
  LOCATE i, th + 3
  IF i = 24 THEN
    PRINT bw$;
  ELSE
    PRINT ew$;
  END IF
  GOSUB delay
NEXT

COLOR nf, nb
FOR i = 1 TO 21
  LOCATE 24 - i, th + 4: PRINT SPC(35);
  IF i = 20 THEN msg$ = "PRESENTS": GOSUB gettb: LOCATE , tb: PRINT msg$
  IF i = 18 THEN
    msg$ = title$: GOSUB gettb
    LOCATE , tb - 2
    FOR a = 1 TO LEN(title$) + 4
      PRINT CHR$(14);
    NEXT
    PRINT
  END IF
  IF i = 17 THEN
    msg$ = title$: GOSUB gettb
```

```
    LOCATE , tb - 2
    PRINT CHR$(14);
    COLOR nf, hb
    PRINT SPC(LEN(title$) + 2);
    COLOR nf, nb
    PRINT CHR$(14)
  END IF
  IF i = 16 THEN
    msg$ = title$: GOSUB gettb
    LOCATE , tb - 2
    PRINT CHR$(14);
    COLOR nf, hb
    PRINT " "; title$; " ";
    COLOR nf, nb
    PRINT CHR$(14)
  END IF
  IF i = 15 THEN
    msg$ = title$: GOSUB gettb
    LOCATE , tb - 2
    PRINT CHR$(14);
    COLOR nf, hb
    PRINT SPC(LEN(title$) + 2);
    COLOR nf, nb
    PRINT CHR$(14)
  END IF
  IF i = 14 THEN
    msg$ = title$: GOSUB gettb
    LOCATE , tb - 2
    FOR a = 1 TO LEN(title$) + 4
      PRINT CHR$(14);
    NEXT
    PRINT
  END IF
  IF i = 12 THEN LOCATE , th + 11: PRINT "          by"
  IF i = 10 THEN LOCATE , th + 11: PRINT "    Marty Petersen"
  IF i = 7 THEN LOCATE , th + 11:  PRINT "    Copyright 1990"
  IF i = 6 THEN LOCATE , th + 11:  PRINT "          by"
  IF i = 4 THEN LOCATE , th + 11:  PRINT "THE COMPUTER SOLUTION"
  IF i = 3 THEN LOCATE , th + 11:  PRINT "    P.O. Box 1263"
  IF i = 2 THEN LOCATE , th + 11:  PRINT "   Vista, CA 92083"
  GOSUB delay
NEXT
GOSUB ANIMATE
GOSUB clearkeyboard
x$ = ""
DO
  x$ = INKEY$
LOOP UNTIL x$ > ""
WIDTH "SCRN:", 80

switch:
IF test$ = "T" THEN
  title$ = "TOEFL TEST ANALYZER"
  testname$ = "TOEFL"
  ext$ = ".TFL"
  hdr$ = "L  S  V  BAT TFL"
  numsections = 5
  section$(1) = " LISTENING"
  section$(2) = " STRUCTURE"
  section$(3) = "VOCABULARY"
  section$(4) = "TOTAL GAIN"
  section$(5) = "TOEFL GAIN"
```

```
ELSE
  title$ = "BEST TEST ANALYZER"
  testname$ = "BEST"
  ext$ = ".BST"
  hdr$ = "O  R  W  TOT    "
  numsections = 4
  section$(1) = "    ORAL  "
  section$(2) = "    READ  "
  section$(3) = "   WRITE  "
  section$(4) = "   TOTAL  "
END IF

'----------- variables for data synthesizer -------
DIM s(2, 3, 2, 2), score(2, 3), subjects(2)
minmax$(1) = "minimum": minmax$(2) = "maximum"
prepost$(1) = "pretest": prepost$(2) = "posttest"
IF test$ = "T" THEN
  lsv$(1) = "listening": lsv$(2) = "structure": lsv$(3) = "vocabulary"
  range$(1) = "(20-68)": range$(2) = "(20-68)": range$(3) = "(20-67)"
ELSE
  lsv$(1) = "oral": lsv$(2) = "read": lsv$(3) = "write"
  range$(1) = "(93 max)": range$(2) = "(49 max)": range$(3) = "(29 max)"
END IF
grp$(1) = "experimental": grp$(2) = "control"

menu:
errtitle$ = "MENU"
ON ERROR GOTO unknownerr
norm = 15: high = 15
IF test$ = "T" THEN back = 1 ELSE back = 3
title$ = testname$ + " PROGRAM MENU"
GOSUB screenhead
LOCATE 8, 25: PRINT "1.  Input "; testname$; " test data."
LOCATE 10, 25: PRINT "2.  Analyze "; testname$; " test data."
LOCATE 12, 25: PRINT "3.  Generate synthetic data."
LOCATE 14, 25
IF INSTR(COMMAND$, "/T") = 0 AND INSTR(COMMAND$, "/B") = 0 THEN
  IF test$ = "T" THEN
    PRINT "4.  Switch to BEST analysis program."
  ELSE
    PRINT "4.  Switch to TOEFL analysis program."
  END IF
END IF
LOCATE 16, 25: PRINT "5.  Quit."
LOCATE 24, 3: PRINT "rev "; revdate$;
LOCATE 18, 25, 1
IF COMMAND$ = "" THEN
  PRINT "    Press 1, 2, 3, 4  or 5 ";
ELSE
  PRINT "    Press 1, 2, 3 or 5 ";
END IF
GOSUB clearkeyboard
redo:
choice$ = ""
DO
  choice$ = INKEY$
LOOP UNTIL VAL(choice$) > 0 AND VAL(choice$) < 6
IF choice$ = "1" THEN GOSUB inputstart: GOTO menu
IF choice$ = "2" THEN GOSUB analystart: GOTO menu
IF choice$ = "3" THEN GOSUB synthstart: GOTO menu
IF choice$ = "4" AND COMMAND$ = "" THEN
  IF test$ = "T" THEN test$ = "B": GOTO switch
```

```
  IF test$ = "B" THEN test$ = "T": GOTO switch
END IF
IF choice$ = "4" AND COMMAND$ > "" THEN GOTO redo
IF choice$ = "5" THEN GOTO theend

inputstart:
ERASE subjects, s, score, lsv, aw, stats
errtitle$ = "INPUTSTART"
ON ERROR GOTO unknownerr
CLOSE
norm = 0: back = 3: high = 15
title$ = "INPUT DATA INTO " + testname$ + " DATAFILE"
GOSUB screenhead
msg$ = "This program inputs data into a datafile."
LOCATE 6, (80 - LEN(msg$)) / 2: COLOR high: PRINT msg$: COLOR norm
fieldlimit = 8
getfile3:
LOCATE 8, 42: PRINT "          (?=list, Q=QUIT)"
LOCATE 8, 15: PRINT "Please enter the filename: ";
GOSUB input1
f$ = UCASE$(x$)
IF f$ = "?" THEN GOSUB currentfiles: GOTO getfile3:
IF f$ = "" OR x$ = "Q" THEN RETURN menu
IF INSTR(f$, ".") = 0 THEN file$ = f$ + ext$
IF INSTR(f$, ".") > 0 THEN
  f$ = LEFT$(f$, INSTR(f$, ".") - 1)
  file$ = f$ + ext$
END IF
getfile4:
ON ERROR GOTO get4err
CLOSE
OPEN "i", 1, file$
count = 0
WHILE NOT EOF(1)
  LINE INPUT #1, txt$
  count = count + 1
WEND
CLOSE

endget4:
IF count > 0 THEN
  msg$ = "New (N) file or Add (A) to existing file? "
  LOCATE 10, (80 - LEN(msg$)) / 2, 1: PRINT msg$;
  GOSUB clearkeyboard
  x$ = ""
  DO
    x$ = UCASE$(INKEY$)
  LOOP UNTIL x$ = "N" OR x$ = "A"
ELSE
  x$ = "O"
END IF
IF x$ = "N" THEN x$ = "O"
OPEN x$, 1, file$
DO
  count = count + 1
  title$ = "ADDING RECORD" + STR$(count) + " TO " + UCASE$(f$)
  GOSUB screenhead
  LOCATE 5, 10: PRINT "Q=QUIT -->       ID:           (1-999)";
  LOCATE 6, 20: PRINT "   GENDER:          (1=male, 2=female)";
  LOCATE 7, 20: PRINT "BIRTHDATE:          (YYMMDD)";
  LOCATE 8, 20: PRINT "  COUNTRY:          (3-number code)";
  LOCATE 9, 20: PRINT " LANGUAGE:          (3-number code)";
```

```
LOCATE 10, 20: PRINT "    GROUP:          (1=exp, 2=ctrl)";
LOCATE 11, 20: PRINT " PRE-DATE:          (YYMMDD)";
IF test$ = "T" THEN
  LOCATE 12, 20: PRINT "    PRE-L:          (20-68)";
  LOCATE 13, 20: PRINT "    PRE-S:          (20-68)";
  LOCATE 14, 20: PRINT "    PRE-V:          (20-67)";
ELSE
  LOCATE 12, 20: PRINT "    PRE-O:          (93 max)";
  LOCATE 13, 20: PRINT "    PRE-R:          (49 max)";
  LOCATE 14, 20: PRINT "    PRE-W:          (29 max)";
END IF
LOCATE 15, 20: PRINT "POST-DATE:          (YYMMDD)";
IF test$ = "T" THEN
  LOCATE 16, 20: PRINT "   POST-L:          (22-68)";
  LOCATE 17, 20: PRINT "   POST-S:          (22-68)";
  LOCATE 18, 20: PRINT "   POST-V:          (22-67)";
ELSE
  LOCATE 16, 20: PRINT "   POST-O:          (93 max)";
  LOCATE 17, 20: PRINT "   POST-R:          (49 max)";
  LOCATE 18, 20: PRINT "   POST-W:          (29 max)";
END IF
LOCATE 19, 20:   PRINT "    HOURS:          (99 max)";
record$ = ""
LOCATE 5, 31: fieldlimit = 3: GOSUB input1
IF x$ = "Q" OR x$ = "q" THEN EXIT DO
GOSUB padit: record$ = record$ + x$ + " "
LOCATE 6, 31: fieldlimit = 1: GOSUB input1
GOSUB padit: record$ = record$ + x$ + " "
LOCATE 7, 31: fieldlimit = 6: GOSUB input1
GOSUB padit: record$ = record$ + x$ + " "
LOCATE 8, 31: fieldlimit = 3: GOSUB input1
GOSUB padit: record$ = record$ + x$ + " "
LOCATE 9, 31: fieldlimit = 3: GOSUB input1
GOSUB padit: record$ = record$ + x$ + " "
LOCATE 10, 31: fieldlimit = 1: GOSUB input1
GOSUB padit: record$ = record$ + x$ + " "
LOCATE 11, 31: fieldlimit = 6: GOSUB input1
GOSUB padit: record$ = record$ + x$ + " "
LOCATE 12, 31: fieldlimit = 2: GOSUB input1
GOSUB padit: record$ = record$ + x$ + " "
LOCATE 13, 31: fieldlimit = 2: GOSUB input1
GOSUB padit: record$ = record$ + x$ + " "
LOCATE 14, 31: fieldlimit = 2: GOSUB input1
GOSUB padit: record$ = record$ + x$ + " "
LOCATE 15, 31: fieldlimit = 6: GOSUB input1
GOSUB padit: record$ = record$ + x$ + " "
LOCATE 16, 31: fieldlimit = 2: GOSUB input1
GOSUB padit: record$ = record$ + x$ + " "
LOCATE 17, 31: fieldlimit = 2: GOSUB input1
GOSUB padit: record$ = record$ + x$ + " "
LOCATE 18, 31: fieldlimit = 2: GOSUB input1
GOSUB padit: record$ = record$ + x$ + " "
LOCATE 19, 31: fieldlimit = 2: GOSUB input1
GOSUB padit: record$ = record$ + x$ + " "
record$ = record$ + "1"
LOCATE 21, 15, 1
PRINT "Save (S) the record, Re-do (R) the record, or Quit (Q) ";
y$ = ""
DO
  y$ = UCASE$(INKEY$)
LOOP UNTIL y$ = "S" OR y$ = "R" OR y$ = "Q"
IF y$ = "R" THEN count = count - 1
```

```
  IF y$ = "S" THEN PRINT #1, record$: record$ = ""
LOOP UNTIL y$ = "Q"
CLOSE
RETURN

padit:
x$ = RTRIM$(x$)
IF LEN(x$) < fieldlimit THEN
  DO
    x$ = " " + x$
  LOOP UNTIL LEN(x$) = fieldlimit
END IF
RETURN

analystart:
ERASE subjects, s, score, lsv, aw, stats
errtitle$ = "ANALYSTART"
ON ERROR GOTO unknownerr
CLOSE
init = 1
norm = 15: back = 1: high = 11
title$ = testname$ + " TEST ANALYZER"
GOSUB screenhead
msg$ = "This program analyzes the data from an existing datafile."
LOCATE 6, (80 - LEN(msg$)) / 2: COLOR high: PRINT msg$: COLOR norm

getfile:
fieldlimit = 8
COLOR high
LOCATE 8, 42: PRINT "         (?=list, Q=QUIT)";
COLOR norm
LOCATE 8, 15: PRINT "Please enter the filename: ";
GOSUB input1
f$ = UCASE$(x$)
IF f$ = "" OR f$ = "Q" THEN RETURN menu
IF f$ = "?" THEN GOSUB currentfiles: GOTO getfile
FOR a = 18 TO 24
  LOCATE a, 3: PRINT SPC(73);
NEXT a

getspecs:
LOCATE 10, 8: COLOR high: PRINT "If you wish to narrow the search,":
COLOR norm
sexcode:
LOCATE 11, 15: PRINT "           Enter sex code:          ";
COLOR high: PRINT "(1=male, 2=female)"; : COLOR norm
LOCATE 11, 42: fieldlimit = 1: GOSUB input1: sx$ = x$
IF VAL(sx$) > 2 THEN BEEP: GOTO sexcode
LOCATE 12, 15: PRINT "       Enter country code: "
LOCATE 12, 42: fieldlimit = 3: GOSUB input1: CNT$ = x$
LOCATE 13, 15: PRINT "      Enter language code: "
LOCATE 13, 42: fieldlimit = 3: GOSUB input1: LNG$ = x$
sx = VAL(sx$): CNT = VAL(CNT$): LNG = VAL(LNG$)
IF INSTR(f$, ".") = 0 THEN file$ = f$ + ext$: df$ = f$ + ".RPT"
IF INSTR(f$, ".") > 0 THEN
  f$ = LEFT$(f$, INSTR(f$, ".") - 1)
  file$ = f$ + ext$
  df$ = f$ + ".RPT"
END IF

sorp:
msg$ = "Screen (S), Printer (P), or Diskfile (D)? "
```

```
LOCATE 15, (80 - LEN(msg$)) / 2, 1: PRINT msg$;
GOSUB clearkeyboard
sp$ = ""
DO
  sp$ = UCASE$(INKEY$)
LOOP UNTIL sp$ = "S" OR sp$ = "P" OR sp$ = "D" OR sp$ = CHR$(27)
IF sp$ = CHR$(27) THEN PRINT : GOTO again
IF sp$ = "S" THEN output$ = "SCRN:": GOTO setoutput
IF sp$ = "D" THEN
  msg$ = "New (N) file or Add (A) to existing file? "
  LOCATE 17, (80 - LEN(msg$)) / 2, 1: PRINT msg$;
  GOSUB clearkeyboard
  x$ = ""
  DO
    x$ = UCASE$(INKEY$)
  LOOP UNTIL x$ = "N" OR x$ = "A"
  output$ = df$
  IF x$ = "N" THEN x$ = "O"
  OPEN x$, 1, df$
  GOSUB screenhead
  LOCATE 10, 34 - LEN(df$)
  PRINT "Saving to file "; UCASE$(df$); " ... ";
  GOTO printgroups
END IF
IF sp$ = "P" THEN output$ = "LPT1:"
COLOR high
LOCATE 17, 16: PRINT "Be sure top edge of paper is at top edge of
ribbon."
LOCATE 18, 19: PRINT "Be sure printer is on line and ready to print."
LOCATE 20, 1
GOSUB presskey
IF sp$ = "P" THEN
  GOSUB screenhead
  LOCATE 10, 30:  COLOR high: PRINT "Printing the report ... ";
  COLOR norm
END IF

setoutput:
OPEN "o", 1, output$

printgroups:
sumitems = 0
FOR grp = 1 TO 3
  IF grp < 3 THEN lineitem = 0 ELSE lineitem = sumitems
  GOSUB header
  IF grp < 3 THEN
    ON ERROR GOTO fileerr
    OPEN "i", 2, file$
    WHILE NOT EOF(2)
      DO
        GOSUB getline
        IF sbj(6) = grp THEN EXIT DO
      LOOP UNTIL EOF(2)
      IF sbj(6) = grp THEN
        lineitem = lineitem + 1
        sumitems = sumitems + 1
        GOSUB printline
        pageline = pageline + 1
        GOSUB checkpage
      END IF
    WEND
    CLOSE 2
```

```
  END IF
  IF grp < 3 THEN
    lsv(grp, 0) = lineitem
    lsv(3, 0) = lsv(3, 0) + lineitem
  END IF
  GOSUB totals
NEXT grp

printgains:
errtitle$ = "PRINTGAINS"
ON ERROR GOTO unknownerr
PRINT #1,
PRINT #1,
PRINT #1, TAB(m + 15);
FOR a = 1 TO numsections - 1
  PRINT #1, section$(a); "  ";
NEXT a
PRINT #1, section$(numsections)
PRINT #1, TAB(m + 15);
FOR a = 1 TO numsections - 1
  PRINT #1, "GAIN   PCT  ";
NEXT a
PRINT #1, "GAIN   PCT"
PRINT #1, TAB(m); STRING$(73, "-")
FOR grp = 1 TO 3
  IF lsv(grp, 0) > 0 THEN
    IF grp = 3 AND (lsv(1, 0) = 0 OR lsv(2, 0) = 0) THEN EXIT FOR
    IF grp = 3 THEN PRINT #1, TAB(m); STRING$(73, "-")
    PRINT #1, TAB(m); g$(grp); "  ";
    gainotot = 0: gainetot = 0
    FOR r = 1 TO 3
      IF test$ = "T" THEN
        gpctdenom = 68
      ELSE
        IF r = 1 THEN gpctdenom = 93
        IF r = 2 THEN gpctdenom = 49
        IF r = 3 THEN gpctdenom = 29
      END IF
      gaino = lsv(grp, r + 3) / lsv(grp, 0)
      gainotot = gainotot + gaino
      gaine = lsv(grp, r) / lsv(grp, 0)
      gainetot = gainetot + gaine
      gain = gaino - gaine
      gainpct = gain / gpctdenom * 100
      PRINT #1, USING "###.#"; gain;
      PRINT #1, " ";
      PRINT #1, USING "###.#"; gainpct;
      PRINT #1, " ";
    NEXT r
    gaintot = gainotot - gainetot
    IF test$ = "T" THEN gpctdenom = 203 ELSE gpctdenom = 171
    gaintotpct = gaintot / gpctdenom * 100
    PRINT #1, USING "####.#"; gaintot;
    PRINT #1, USING "###.#"; gaintotpct;
    PRINT #1, " ";
    IF test$ = "T" THEN
      tgotot = gainotot * 10 / 3
      tgetot = gainetot * 10 / 3
      tgtot = tgotot - tgetot
      tgtotpct = tgtot / 677 * 100
      PRINT #1, USING "####.#"; tgtot;
      PRINT #1, USING "###.#"; tgtotpct
```

```
    ELSE
      PRINT #1,
    END IF
  END IF
NEXT grp
PRINT #1,
PRINT #1,
IF sp$ = "S" THEN GOSUB presskey
LOCATE , 3: PRINT
LOCATE , 3: PRINT
COLOR high
LOCATE , 23: PRINT "Calculating the statistics ... ";
COLOR norm
GOSUB getstats
IF sp$ = "S" THEN CLS : PRINT
GOSUB showstats
IF sp$ = "P" OR sp$ = "D" THEN
  GOSUB explain
  PRINT #1, CHR$(12): PRINT
END IF
IF th = 0 THEN
  msg$ = "Graph the results (Y/N)? "
  PRINT
  LOCATE , ((80 - LEN(msg$)) / 2), 1
  PRINT msg$;
  x$ = ""
  DO
    x$ = UCASE$(INKEY$)
  LOOP UNTIL x$ = "Y" OR x$ = "N"
  IF x$ = "Y" THEN GOSUB graph1
  IF INSTR(COMMAND$, "/S") > 0 THEN GOSUB screenhead: LOCATE 5, 1
ELSE
  GOSUB presskey
END IF

again0:
IF INSTR(COMMAND$, "/S") = 0 THEN GOSUB makespss

again:
PRINT
again2:
IF CSRLIN > 23 THEN GOSUB screenhead: LOCATE 5, 1
msg$ = "Do you want to analyze another file (Y/N)? "
LOCATE , (80 - LEN(msg$)) / 2, 1: PRINT msg$;
GOSUB clearkeyboard
x$ = ""
DO
  x$ = UCASE$(INKEY$)
LOOP UNTIL x$ = "Y" OR x$ = "N"
IF x$ = "Y" THEN GOTO analystart
RETURN

theend:
CLOSE
CLS
END

unknownerr:
title$ = "UNKNOWN ERROR in " + errtitle$
norm = 14: back = 4: high = 15
GOSUB screenhead
LOCATE 10, 27: PRINT "Don't ask ME what happened!"
```

```
LOCATE 12, 29: PRINT "(I don't know, either.)"
LOCATE 14, 25: PRINT "Go complain to Marty Petersen"
LOCATE 15, 25: PRINT "that error #"; ERR; "is what put me"
LOCATE 16, 24: PRINT "in this embarrassing situation."
LOCATE 20: GOSUB presskey
RESUME menu

grapherr:
th = 20
SCREEN 0
WIDTH "SCRN:", 80
RESUME endgrapherr

fileerr:
PRINT
msg$ = "There is a problem finding the data file."
LOCATE , (80 - LEN(msg$)) / 2
PRINT msg$
RESUME again

outputerr:
CLOSE
PRINT : PRINT
IF sp$ = "P" THEN msg2$ = "printer."
IF sp$ = "D" THEN msg2$ = "report file."
msg$ = "There is a problem finding the " + msg2$
LOCATE , (80 - LEN(msg$)) / 2
PRINT msg$
RESUME sorp

currenterr:
RESUME endcurrenterr

get4err:
RESUME endget4

input1:
LOCATE , , 1
xlen = LEN(x$)
x$ = "": x1$ = ""
vcurs = CSRLIN: hcurs = POS(0): LFG = 0
DO UNTIL x1$ = CHR$(13)
  x1$ = INKEY$
  IF x1$ > "" THEN x1$ = UCASE$(x1$)
  IF x1$ > "" AND anykey = 1 THEN anykey = 0: RETURN
  IF LEN(x$) = 1 AND LFG = 0 THEN
    LFG = 1: hh = POS(0): PRINT SPC(xlen - 1); : LOCATE , hh
  END IF
  IF x1$ >= " " AND x1$ <= "~" THEN
    x$ = x$ + x1$
    IF LEN(x$) > fieldlimit THEN
      BEEP: x$ = LEFT$(x$, fieldlimit)
      x1$ = ""
    ELSE
      PRINT x1$;
    END IF
  END IF
  ''IF x1$ = CHR$(27) THEN CLOSE : RETURN menu
  IF x1$ = CHR$(8) THEN
    LOCATE vcurs, hcurs
    PRINT STRING$(LEN(x$), " ");
    IF LEN(x$) > 0 THEN x$ = LEFT$(x$, LEN(x$) - 1)
```

```
    LOCATE vcurs, hcurs
    PRINT x$;
  END IF
LOOP
PRINT
RETURN

presskey:
GOSUB clearkeyboard
PRINT
LOCATE , 24
COLOR high: PRINT "Press any key to continue ... "; : COLOR norm
z$ = ""
DO
  z$ = INKEY$
LOOP UNTIL z$ > ""
IF z$ = CHR$(27) THEN PRINT : RETURN menu
RETURN

printline:
IF sbj(1) > 999 THEN
  DO
    sbj(1) = sbj(1) - 1000
  LOOP UNTIL sbj(1) < 1000
END IF
IF sbj(1) > 0 THEN
  PRINT #1, TAB(m); USING "###"; sbj(1); :  'ID
ELSE
  PRINT #1, "???";
END IF
PRINT #1, " ";
IF sbj(2) = 1 THEN PRINT #1, "M "; :  'SEX
IF sbj(2) = 2 THEN PRINT #1, "F ";
IF sbj(2) = 0 THEN PRINT #1, "? ";
IF sbj(4) > 0 THEN
  PRINT #1, USING "###"; sbj(4); :  'native country code
ELSE
  PRINT #1, "???";
END IF
PRINT #1, " ";
IF sbj(5) > 0 THEN
  PRINT #1, USING "###"; sbj(5); :  'native language code
ELSE
  PRINT #1, "???";
END IF
PRINT #1, " ";
IF sbj(3) = 0 OR sbj(7) = 0 THEN
  aw(grp, 1, 0) = 1
  aw(3, 1, 0) = 1
  PRINT #1, "??";
ELSE
  yymmdd = sbj(3): GOSUB daynumber: d1 = daynum:  'birth date
  yymmdd = sbj(7): GOSUB daynumber: d2 = daynum:  'pre-test date
  age = (d2 - d1) / 365
  IF age > 0 THEN
    PRINT #1, USING "##"; age;
    aw(grp, 1, 1) = aw(grp, 1, 1) + age
    aw(grp, 1, 2) = aw(grp, 1, 2) + 1
  ELSE
    aw(grp, 1, 0) = 1
    aw(3, 1, 0) = 1
    PRINT #1, "??";
```

```
  END IF
END IF
PRINT #1, "   ";
FOR B = 8 TO 10
  PRINT #1, USING "##"; sbj(B);
  PRINT #1, " ";
  lsv(grp, B - 7) = lsv(grp, B - 7) + sbj(B)
  lsv(3, B - 7) = lsv(3, B - 7) + sbj(B)
NEXT B
PRINT #1, " ";
e123 = sbj(8) + sbj(9) + sbj(10)
etoefl = e123 * 10 / 3
PRINT #1, USING "###"; e123;
PRINT #1, " ";
IF test$ = "T" THEN
  PRINT #1, USING "###"; etoefl;
ELSE
  PRINT #1, "   ";
END IF
PRINT #1, "  ";
IF sbj(7) = 0 OR sbj(11) = 0 THEN
  aw(grp, 2, 0) = 1
  aw(3, 2, 0) = 1
  PRINT #1, "??";
ELSE
  yymmdd = sbj(7): GOSUB daynumber: d1 = daynum:  'pre-test date
  yymmdd = sbj(11): GOSUB daynumber: d2 = daynum:  'post-test date
  weeks = (d2 - d1) / 7
  IF weeks > 0 THEN
    PRINT #1, USING "##"; weeks;
    aw(grp, 2, 1) = aw(grp, 2, 1) + weeks
    aw(grp, 2, 2) = aw(grp, 2, 2) + 1
  ELSE
    aw(grp, 2, 0) = 1
    aw(3, 2, 0) = 1
    PRINT #1, "???";
  END IF
END IF
PRINT #1, " ";

IF sbj(15) = 0 THEN
  aw(grp, 3, 0) = 1
  aw(3, 3, 0) = 1
  PRINT #1, "??";
ELSE
  hours = sbj(15)
  IF hours > 0 THEN
    PRINT #1, USING "##"; hours;
    aw(grp, 3, 1) = aw(grp, 3, 1) + hours
    aw(grp, 3, 2) = aw(grp, 3, 2) + 1
  ELSE
    aw(grp, 3, 0) = 1
    aw(3, 3, 0) = 1
    PRINT #1, "???";
  END IF
END IF
PRINT #1, "  ";
FOR B = 12 TO 14
  PRINT #1, USING "##"; sbj(B);
  PRINT #1, " ";
  lsv(grp, B - 8) = lsv(grp, B - 8) + sbj(B)
  lsv(3, B - 8) = lsv(3, B - 8) + sbj(B)
```

```
NEXT B
PRINT #1, " ";
o123 = sbj(12) + sbj(13) + sbj(14)
otoefl = o123 * 10 / 3
PRINT #1, USING "###"; o123;
PRINT #1, " ";
IF test$ = "T" THEN
  PRINT #1, USING "###"; otoefl;
ELSE
  PRINT #1, "   ";
END IF
PRINT #1, "  ";
PRINT #1, USING "####"; o123 - e123;
PRINT #1, " ";
IF test$ = "T" THEN
  PRINT #1, USING "####"; otoefl - etoefl
ELSE
  PRINT #1,
END IF
RETURN

totals:
errtitle$ = "TOTALS"
ON ERROR GOTO unknownerr
IF lsv(grp, 0) = 0 THEN
  PRINT
  msg$ = "No data for this group."
  PRINT #1, TAB((80 - LEN(msg$)) / 2); msg$
  IF grp = 3 THEN
    IF sp$ = "P" OR sp$ = "D" THEN
      LOCATE , ((80 - LEN(msg$)) / 2): PRINT msg$
    END IF
    RETURN again
  END IF
  IF sp$ = "S" THEN GOSUB presskey
  RETURN
END IF
IF grp = 3 AND (lsv(1, 0) = 0 OR lsv(2, 0) = 0) THEN
  PRINT
  msg$ = "No data to combine."
  PRINT #1, TAB((80 - LEN(msg$)) / 2); msg$
  IF sp$ = "S" THEN GOSUB presskey
  RETURN
END IF
IF grp < 3 THEN
  IF aw(grp, 1, 1) > 0 AND aw(grp, 1, 2) > 0 THEN
    avage = aw(grp, 1, 1) / aw(grp, 1, 2)
  ELSE
    avage = 0
  END IF
  IF aw(grp, 2, 1) > 0 AND aw(grp, 2, 2) > 0 THEN
    avweeks = aw(grp, 2, 1) / aw(grp, 2, 2)
  ELSE
    avweeks = 0
  END IF
  IF aw(grp, 3, 1) > 0 AND aw(grp, 3, 2) > 0 THEN
    avhours = aw(grp, 3, 1) / aw(grp, 3, 2)
  ELSE
    avhours = 0
  END IF
ELSE
  IF aw(1, 1, 2) > 0 AND aw(2, 1, 2) > 0 THEN
```

```
    avage = (aw(1, 1, 1) + aw(2, 1, 1)) / (aw(1, 1, 2) + aw(2, 1, 2))
  ELSE
    avage = 0
  END IF
  IF aw(1, 2, 2) > 0 AND aw(2, 2, 2) > 0 THEN
    avweeks = (aw(1, 2, 1) + aw(2, 2, 1)) / (aw(1, 2, 2) + aw(2, 2, 2))
  ELSE
    avweeks = 0
  END IF
  IF aw(1, 3, 2) > 0 AND aw(2, 3, 2) > 0 THEN
    avhours = (aw(1, 3, 1) + aw(2, 3, 1)) / (aw(1, 3, 2) + aw(2, 3, 2))
  ELSE
    avhours = 0
  END IF
END IF
IF grp < 3 THEN PRINT #1, TAB(m + 14); STRING$(59, "-")
PRINT #1, TAB(m); USING "###"; lineitem;
PRINT #1, " cases      ";
IF avage > 0 THEN PRINT #1, USING "##"; avage;  ELSE PRINT #1, "??";
IF aw(grp, 1, 0) = 1 THEN PRINT #1, "?  ";  ELSE PRINT #1, "   ";
FOR B = 1 TO 3
  PRINT #1, USING "##"; lsv(grp, B) / lineitem;
  PRINT #1, " ";
NEXT B
PRINT #1, " ";
e123tot = 0
FOR B = 1 TO 3
  e123tot = e123tot + lsv(grp, B) / lineitem
NEXT B
etfltot = e123tot * 10 / 3
PRINT #1, USING "###"; e123tot;
PRINT #1, " ";
IF test$ = "T" THEN
  PRINT #1, USING "###"; etfltot;
ELSE
  PRINT #1, "   ";
END IF
PRINT #1, "  ";
IF avweeks > 0 THEN PRINT #1, USING "##"; avweeks;  ELSE PRINT #1, "??";
'''IF aw(grp, 2, 0) = 1 THEN PRINT #1, "?";  ELSE PRINT #1, " ";
PRINT #1, " ";
IF avhours > 0 THEN PRINT #1, USING "##"; avhours;  ELSE PRINT #1, "??";
PRINT #1, "  ";
FOR B = 4 TO 6
  PRINT #1, USING "##"; lsv(grp, B) / lineitem;
  PRINT #1, " ";
NEXT B
PRINT #1, " ";
o123tot = 0
FOR B = 4 TO 6
  o123tot = o123tot + lsv(grp, B) / lineitem
NEXT B
otfltot = o123tot * 10 / 3
PRINT #1, USING "###"; o123tot;
PRINT #1, " ";
IF test$ = "T" THEN
  PRINT #1, USING "###"; otfltot;
ELSE
  PRINT #1, "   ";
END IF
PRINT #1, USING "####.#"; o123tot - e123tot;
IF test$ = "T" THEN
```

```
  PRINT #1, USING "###.#"; otfltot - etfltot
ELSE
  PRINT #1,
END IF
IF sp$ = "S" AND grp < 3 THEN GOSUB presskey
RETURN

header:
ON ERROR GOTO outputerr
IF init = 1 THEN
  init = 0
ELSE
  IF sp$ <> "S" THEN PRINT #1, CHR$(12)
END IF
IF sp$ = "S" THEN CLS : PRINT
IF sp$ = "P" THEN
  FOR a = 1 TO 3
    PRINT #1,
  NEXT a
END IF
PRINT #1, TAB(m); testname$; ": "; f$; "       CASES: ";
IF sx = 0 AND CNT = 0 AND LNG = 0 THEN PRINT #1, "ALL";
IF sx > 0 THEN PRINT #1, "S="; USING "#"; sx; : PRINT #1, "  ";
IF CNT > 0 THEN PRINT #1, "CNT="; USING "###"; CNT; : PRINT #1, "  ";
IF LNG > 0 THEN PRINT #1, "LNG="; USING "###"; LNG;
PRINT #1, TAB(m + 73 - LEN(g$(grp))); g$(grp)
PRINT #1,
'''head
PRINT #1, TAB(m); "-----SUBJECT-----  -----PRE-TEST----   time  ";
PRINT #1, "----POST-TEST----  ";
PRINT #1, "--GAIN---"
PRINT #1, TAB(m); " ID S CNT LNG AGE   "; hdr$; "  WK HR   ";
PRINT #1, hdr$; " ";
IF test$ = "T" THEN
  PRINT #1, "  BAT  TFL"
ELSE
  PRINT #1, "  TOT"
END IF
PRINT #1, TAB(m); STRING$(73, "-")
IF sp$ = "S" THEN pageline = 5 ELSE pageline = 8
RETURN

checkpage:
IF sp$ = "P" OR sp$ = "D" THEN
  IF pageline > 56 THEN GOSUB header
ELSE
  IF pageline > 20 THEN
    GOSUB presskey
    GOSUB header
  END IF
END IF
RETURN

explain:
errtitle$ = "EXPLAIN"
ON ERROR GOTO unknownerr
PRINT #1,
PRINT #1, TAB(m); "Explanation of column headings and symbols:"
PRINT #1, TAB(m); "-------------------------------------------"
PRINT #1, TAB(m); " ID = case number of subject"
PRINT #1, TAB(m); "  S = sex of subject"
PRINT #1, TAB(m); "CNT = native country code of subject"
```

```
PRINT #1, TAB(m); "LNG = native language code of subject"
PRINT #1, TAB(m); "AGE = age of subject at time of pre-test"
IF test$ = "T" THEN
  PRINT #1, TAB(m); "  L = listening score"
  PRINT #1, TAB(m); "  S = structure score"
  PRINT #1, TAB(m); "  V = vocabulary score"
  PRINT #1, TAB(m); "BAT = sum of listening, structure, and vocabulary
                      scores"
  PRINT #1, TAB(m); "TFL = TOEFL score (BAT score x 10 / 3)"
ELSE
  PRINT #1, TAB(m); "  O = oral (core) score"
  PRINT #1, TAB(m); "  R = read score"
  PRINT #1, TAB(m); "  W = write score"
  PRINT #1, TAB(m); "TOT = sum of oral, read, and write scores"
END IF
PRINT #1, TAB(m); " WK = time in weeks between tests"
PRINT #1, TAB(m); " HR = number of hours of instruction"
PRINT #1, TAB(m); "  ? = missing age, weeks or hours data"
PRINT #1, TAB(m); "  * = 2-tail results are significant at alpha = .01"
PRINT #1, TAB(m); "  + = 2-tail results are significant at alpha = .05"
RETURN

getstats:
errtitle$ = "GETSTATS"
ON ERROR GOTO unknownerr
IF test$ = "T" THEN ww = 16 ELSE ww = 13
IF lsv(1, 0) = 0 THEN
  IF test$ = "T" THEN ww = ww - 10 ELSE ww = ww - 8
END IF
IF lsv(2, 0) = 0 THEN
  IF test$ = "T" THEN ww = ww - 10 ELSE ww = ww - 8
END IF
COLOR high
w = POS(0): LOCATE , w + ww: PRINT "|"; : LOCATE , w
COLOR norm
FOR grp = 1 TO 3
  IF lsv(grp, 0) > 0 THEN
    IF grp = 3 AND (lsv(1, 0) = 0 OR lsv(2, 0) = 0) THEN PRINT ">":
RETURN
    n = lsv(grp, 0)
    FOR section = 1 TO numsections
      PRINT ">";
      sumx = 0: sum2x = 0: sumx1 = 0: sum2x1 = 0: sumx2 = 0: sum2x2 = 0
      sumpo = 0: sumpe = 0: sumpoe = 0: sumpo2 = 0: sumpe2 = 0
      IF grp < 3 THEN
        OPEN "i", 2, file$
        WHILE NOT EOF(2)
          GOSUB getline
          IF sbj(6) = grp THEN
            IF section = 4 OR section = 5 THEN
              fo = sbj(12) + sbj(13) + sbj(14)
              fe = sbj(8) + sbj(9) + sbj(10)
              f = fo - fe
              IF section = 5 THEN
                f = f * 10 / 3
                fo = fo * 10 / 3
                fe = fe * 10 / 3
              END IF
            ELSE
              f = sbj(section + 11) - sbj(section + 7)
              fo = sbj(section + 11)
              fe = sbj(section + 7)
```

```
        f = fo - fe
      END IF
      sumx = sumx + f
      sum2x = sum2x + f ^ 2
      sumpo = sumpo + fo
      sumpe = sumpe + fe
      sumpoe = sumpoe + fo * fe
      sumpo2 = sumpo2 + fo ^ 2
      sumpe2 = sumpe2 + fe ^ 2
    END IF
  WEND
  CLOSE 2
ELSE
  FOR g = 1 TO 2
    OPEN "i", 2, file$
    WHILE NOT EOF(2)
      GOSUB getline
      IF sbj(6) = g THEN
        IF section = 4 OR section = 5 THEN
          fo = sbj(12) + sbj(13) + sbj(14)
          fe = sbj(8) + sbj(9) + sbj(10)
          f = fo - fe
          IF section = 5 THEN f = f * 10 / 3
        ELSE
          fo = sbj(section + 11)
          fe = sbj(section + 7)
          f = fo - fe
        END IF
        sumx = sumx + f
        sum2x = sum2x + f ^ 2
        IF g = 1 THEN
          sumx1 = sumx1 + f
          sum2x1 = sum2x1 + f ^ 2
        ELSE
          sumx2 = sumx2 + f
          sum2x2 = sum2x2 + f ^ 2
        END IF
      END IF
    WEND
    CLOSE 2
  NEXT g
END IF
ON ERROR GOTO unknownerr
stats(grp, section, 1) = mean(sumx, n)
stats(grp, section, 2) = sdev(sumx, sum2x, n)
IF grp = 3 THEN
  IF lsv(1, 0) = lsv(2, 0) THEN
    stats(grp, section, 3) = tpairs(sumx, sum2x, n)
    ttype$ = "P"
  ELSE
    stats(grp, section, 3) = tindgrp(sumx1, sum2x1, lsv(1, 0),
                             sumx2, sum2x2, lsv(2, 0))
    ttype$ = "I"
  END IF
ELSE
  stats(grp, section, 3) = tpairs(sumx, sum2x, n)
  ttype$ = "P"
END IF
tp = stats(grp, section, 3)
IF ttype$ = "P" THEN
  df = lsv(grp, 0) - 1
ELSE
```

```
        df = lsv(grp, 0) - 2
      END IF
      IF df > 30 THEN df = 30
      stats(grp, section, 4) = t2tail(tp, df, dt())
      IF grp < 3 THEN
        stats(grp, section, 5) = pearson(sumpo, sumpe, sumpoe, sumpo2,
                                 sumpe2, n)
      END IF
    NEXT section
  END IF
NEXT grp
PRINT ">"
RETURN

showstats:
errtitle$ = "SHOWSTATS"
ON ERROR GOTO unknownerr
FOR grp = 1 TO 3
  IF lsv(grp, 0) > 0 THEN
    IF grp = 3 AND (lsv(1, 0) = 0 OR lsv(2, 0) = 0) THEN RETURN
    IF grp = 3 THEN
      IF lsv(1, 0) = lsv(2, 0) THEN
        ttype$ = "P"
      ELSE
        ttype$ = "I"
      END IF
    ELSE
      ttype$ = "P"
    END IF
    PRINT #1, TAB(m); g$(grp); ":";
    PRINT #1, TAB(m + 16);
    IF test$ = "T" THEN
      PRINT #1, "LISTENING   STRUCTURE  VOCABULARY   TOTAL BAT
TOEFL"
    ELSE
      PRINT #1, "     ORAL         READ        WRITE        TOTAL"
    END IF
    PRINT #1, TAB(m); STRING$(73, "-")
    FOR stat = 1 TO 5
      IF stat = 1 THEN PRINT #1, TAB(m); "   gain mean:";
      IF stat = 2 THEN PRINT #1, TAB(m); "   gain sdev:";
      IF stat = 3 AND ttype$ = "I" THEN
        PRINT #1, TAB(m); "     t (ind):";
      end if
      IF stat = 3 AND ttype$ = "P" THEN
        PRINT #1, TAB(m); "     t (cor):";
      end if
      IF stat = 4 THEN PRINT #1, TAB(m); "  p (2-tail):";
      IF stat = 5 AND grp = 3 THEN RETURN
      IF stat = 5 THEN PRINT #1, TAB(m); "     pearson:";
      PRINT #1, TAB(m + 16);
      FOR section = 1 TO numsections
        IF stats(grp, section, stat) > -999 AND stats(grp, section,
      stat) < 9999 THEN
          PRINT #1, USING "####.####"; stats(grp, section, stat);
          t2 = stats(grp, section, stat)
        ELSE
          IF stats(grp, section, stat) > 0 THEN
            PRINT #1, "  > +9999";
          ELSE
            PRINT #1, "  <  -999";
          END IF
```

```
          t2 = 1
        END IF
        IF stat = 4 AND t2 < .05 AND t2 > .01 THEN
          PRINT #1, "+";
        ELSE
          IF stat = 4 AND t2 <= .01 THEN
            PRINT #1, "*";
          ELSE
            PRINT #1, " ";
          END IF
        END IF
        IF section < 5 THEN
          PRINT #1, "  ";nextsection
        END IF
      NEXT section
      PRINT #1,
    NEXT stat
    IF sp$ = "P" OR sp$ = "D" THEN PRINT #1,
    IF sp$ = "S" AND grp < 3 THEN PRINT
  END IF
NEXT grp
RETURN

screenhead:
COLOR high, back, 0: CLS
COLOR , 0: LOCATE 1, 1: PRINT STRING$(80, " "); : COLOR , back
LOCATE 2, 1
PRINT "╔═══════════════════════════════════════";
PRINT "═══════════════════════════════════════╗";
FOR aa = 3 TO 24
  LOCATE aa, 1: PRINT "║"; : LOCATE aa, 80: PRINT "║";
NEXT
LOCATE 25, 1
PRINT "╚═══════════════════════════════════════";
PRINT "═══════════════════════════════════════╝";
LOCATE 1, 1: LENTTL = LEN(title$): LENBOX = LENTTL + 4
TABBOX = ((81 - LENBOX) / 2)
LOCATE , TABBOX: PRINT CHR$(218);
FOR aa = 1 TO LENTTL + 2: PRINT CHR$(196); : NEXT
PRINT CHR$(191): LOCATE , (TABBOX)
PRINT CHR$(181); " "; title$; " "; CHR$(198)
LOCATE , TABBOX: PRINT CHR$(192);
FOR aa = 1 TO LENTTL + 2: PRINT CHR$(196); : NEXT
PRINT CHR$(217)
COLOR norm, back
RETURN

clearkeyboard:
DEF SEG = 0
POKE 1050, PEEK(1052)
RETURN

daynumber:
vy = INT(yymmdd / 10000)
vm = INT((yymmdd / 10000 - vy) * 100)
vd = yymmdd - 10000 * vy - 100 * vm
vy = 1900 + vy
delta = 78
IF vy < 1583 THEN
  daynum = -287 + m(vm) + vd
ELSE
```

```
  daynum = delta + (vy - 1583) * 365 + m(vm) + vd
  IF vy > 1583 THEN daynum = daynum + INT((vy - 1580) / 4)
  IF vy > 1599 THEN daynum = daynum - INT((vy - 1600) / 100)
  IF vy > 1599 THEN daynum = daynum + INT((vy - 1600) / 400)
  IF (vy / 4) = INT(vy / 4) AND vm < 3 THEN daynum = daynum - 1
  IF (vy / 100 = INT(vy / 100)) AND vm < 3 THEN daynum = daynum + 1
  IF (vy / 400 = INT(vy / 400)) AND vm < 3 THEN daynum = daynum - 1
END IF
RETURN

getline:
ON ERROR GOTO fileerr
DO
  ERASE sbj
  flag = 0: ok = 0
  LINE INPUT #2, txt$
  IF sx$ > "" AND MID$(txt$, 5, 1) <> sx$ THEN flag = 1
  IF CNT$ > "" AND MID$(txt$, 14, 3) <> CNT$ THEN flag = 1
  IF LNG$ > "" AND MID$(txt$, 18, 3) <> LNG$ THEN flag = 1
  IF MID$(txt$, 59, 1) = "0" THEN flag = 1
  IF flag = 0 THEN
    ok = 1
    sbj(1) = VAL(MID$(txt$, 1, 3))
    sbj(2) = VAL(MID$(txt$, 5, 1))
    sbj(3) = VAL(MID$(txt$, 7, 6))
    sbj(4) = VAL(MID$(txt$, 14, 3))
    sbj(5) = VAL(MID$(txt$, 18, 3))
    sbj(6) = VAL(MID$(txt$, 22, 1))
    sbj(7) = VAL(MID$(txt$, 24, 6))
    sbj(8) = VAL(MID$(txt$, 31, 2)): IF sbj(8) = 0 THEN ok = 0
    sbj(9) = VAL(MID$(txt$, 34, 2)): IF sbj(9) = 0 THEN ok = 0
    sbj(10) = VAL(MID$(txt$, 37, 2)): IF sbj(10) = 0 THEN ok = 0
    sbj(11) = VAL(MID$(txt$, 40, 6))
    sbj(12) = VAL(MID$(txt$, 47, 2)): IF sbj(12) = 0 THEN ok = 0
    sbj(13) = VAL(MID$(txt$, 50, 2)): IF sbj(13) = 0 THEN ok = 0
    sbj(14) = VAL(MID$(txt$, 53, 2)): IF sbj(14) = 0 THEN ok = 0
    sbj(15) = VAL(MID$(txt$, 56, 2))
  END IF
LOOP UNTIL ok = 1 OR EOF(2)
RETURN

ANIMATE:
td = 0
msg$ = title$: GOSUB gettb
FOR g = 1 TO 3
  FOR a = (tb - 2) TO (tb + LEN(title$) + 1)
    GOSUB delay
    LOCATE 6, a
    IF g / 2 = INT(g / 2) THEN PRINT CHR$(250);  ELSE PRINT CHR$(14);
  NEXT

  FOR B = 7 TO 9
    GOSUB delay
    LOCATE B, tb + LEN(title$) + 1
    IF g / 2 = INT(g / 2) THEN PRINT CHR$(250);  ELSE PRINT CHR$(14);
  NEXT

  FOR c = (tb + LEN(title$) + 1) TO (tb - 2) STEP -1
    GOSUB delay
    LOCATE 10, c
    IF g / 2 = INT(g / 2) THEN PRINT CHR$(250);  ELSE PRINT CHR$(14);
  NEXT
```

```
  FOR d = 9 TO 7 STEP -1
    GOSUB delay
    LOCATE d, tb - 2
    IF g / 2 = INT(g / 2) THEN PRINT CHR$(250);  ELSE PRINT CHR$(14);
  NEXT

NEXT g
RETURN

delay:
z = TIMER
DO
LOOP WHILE TIMER - z < td
RETURN

gettb:
tb = INT((th + 2 + (40 - LEN(msg$)) / 2) + .5)
RETURN

graph1:
xcount = lsv(1, 0): ccount = lsv(2, 0)
FOR section = 1 TO numsections
  CLS
  IF section = 1 THEN
    IF test$ = "T" THEN
      factor = 100 / 68
      graphttl$ = "TOEFL LISTENING"
    ELSE
      factor = 100 / 93
      graphttl$ = "BEST ORAL"
    END IF
  END IF
  IF section = 2 THEN
    IF test$ = "T" THEN
      factor = 100 / 68
      graphttl$ = "TOEFL STRUCTURE"
    ELSE
      factor = 100 / 49
      graphttl$ = "BEST READ"
    END IF
  END IF
  IF section = 3 THEN
    IF test$ = "T" THEN
      factor = 100 / 67
      graphttl$ = "TOEFL VOCABULARY"
    ELSE
      factor = 100 / 29
      graphttl$ = "BEST WRITE"
    END IF
  END IF
  IF section = 4 THEN
    IF test$ = "T" THEN
      factor = 100 / (68 + 68 + 67)
      graphttl$ = "TOEFL BATTERY"
    ELSE
      factor = 100 / (93 + 49 + 29)
      graphttl$ = "BEST TOTAL"
    END IF
  END IF
  IF section = 5 THEN
    factor = 100 / ((68 + 68 + 67) * 10 / 3)
```

```
  graphttl$ = "TOEFL FINAL"
END IF
gfactor = factor * 4
IF xcount > 0 THEN xok = 1 ELSE xok = 0
IF ccount > 0 THEN cok = 1 ELSE cok = 0
IF section = 5 THEN xx = 1 ELSE xx = 0
xesum = 0: xosum = 0: cesum = 0: cosum = 0
IF section < 4 THEN
  IF xok = 1 THEN
    xesum = lsv(1, section)
    xosum = lsv(1, section + 3)
  END IF
  IF cok = 1 THEN
    cesum = lsv(2, section)
    cosum = lsv(2, section + 3)
  END IF
ELSE
  IF xok = 1 THEN
    xesum = lsv(1, section - 3 - xx)
    xesum = xesum + lsv(1, section - 2 - xx)
    xesum = xesum + lsv(1, section - 1 - xx)
    xosum = lsv(1, section - xx)
    xosum = xosum + lsv(1, section + 1 - xx)
    xosum = xosum + lsv(1, section + 2 - xx)
  END IF
  IF cok = 1 THEN
    cesum = lsv(2, section - 3 - xx)
    cesum = cesum + lsv(2, section - 2 - xx)
    cesum = cesum + lsv(2, section - 1 - xx)
    cosum = lsv(2, section - xx)
    cosum = cosum + lsv(2, section + 1 - xx)
    cosum = cosum + lsv(2, section + 2 - xx)
  END IF
  IF section = 5 THEN
    IF xok = 1 THEN
      xesum = xesum * 10 / 3
      xosum = xosum * 10 / 3
    END IF
    IF cok = 1 THEN
      cesum = cesum * 10 / 3
      cosum = cosum * 10 / 3
    END IF
  END IF
END IF
SCREEN 2
vv = 8: hh = 8
h = 16.5 * hh
PRINT
PRINT
ctab = LEN(f$) + LEN(graphttl$) + 17
ctab = INT(((80 - ctab) / 2) + .5)
PRINT TAB(ctab); UCASE$(f$); " GAINS  -  "; graphttl$; " SCORES"
PRINT
hpos = 20: vpos = CSRLIN - 1
PRINT TAB(hpos); "    = POSITIVE GAIN,      = NEGATIVE GAIN"
LINE (hpos * 8, vpos * 8)-((hpos + 2) * 8, ((vpos + 1) * 8) - 2), , BF
LINE ((hpos + 21) * 8, vpos * 8)-((hpos + 23) * 8, ((vpos + 1) * 8) -
    2), , B
PRINT
cond$ = ""
IF sx$ > "" THEN cond$ = "SEX=" + sx$
IF CNT$ > "" THEN
```

```
    c$ = "COUNTRY=" + CNT$
    IF cond$ > "" THEN
      cond$ = cond$ + "  " + c$
    ELSE
      cond$ = cond$ + c$
    END IF
  END IF
  IF LNG$ > "" THEN
    c$ = "LANGUAGE=" + LNG$
    IF cond$ > "" THEN
      cond$ = cond$ + "  " + c$
    ELSE
      cond$ = cond$ + c$
    END IF
  END IF
  IF cond$ > "" THEN
    cond$ = "CASES: " + cond$
  ELSE
    cond$ = "CASES: ALL"
  END IF
  ctab = INT(((80 - LEN(cond$)) / 2) + .5)
  PRINT TAB(ctab); cond$
  PRINT
  vtop = CSRLIN - 1
  PRINT "    GROUP/COUNT";
  PRINT TAB(70); "GAIN/PCT"
  PRINT
  IF xok = 1 THEN
    PRINT "   EXPERIMENTAL   ";
    v = (CSRLIN - 1) * vv: x1 = xesum / xcount: x2 = xosum / xcount:
GOSUB sub1
    PRINT "             ";
    PRINT USING "###"; xcount
  ELSE
    PRINT
    PRINT
  END IF
  PRINT
  IF cok = 1 THEN
    PRINT "         CONTROL   ";
    v = (CSRLIN - 1) * vv: x1 = cesum / ccount: x2 = cosum / ccount:
GOSUB sub1
    PRINT "             ";
    PRINT USING "###"; ccount
  ELSE
    PRINT
    PRINT
  END IF
  PRINT
  IF xok = 1 AND cok = 1 THEN
    PRINT "       COMBINED   ";
    v = (CSRLIN - 1) * vv
    x1 = (xesum + cesum) / (xcount + ccount)
    x2 = (xosum + cosum) / (xcount + ccount)
    GOSUB sub1
    PRINT "             ";
    PRINT USING "###"; xcount + ccount
  ELSE
    PRINT
    PRINT
  END IF
  PRINT
```

```
  vbot = CSRLIN - 1
  PRINT TAB(17); "     +    +    +    +    +    +    +";
  PRINT "    +    +    +"
  PRINT TAB(7); "              10%  20%  30%  40%  50%  60%  70%";
  PRINT "  80%  90%  100%"
  PRINT
  PRINT TAB(30); "CONVERTED SCORES ("; INT((1 / factor * 100) + .5);
    "max )"
  LINE (hh * 16.3, vtop * 8)-(hh * 16.3, (vbot * 8) + 3)
  LINE (hh * 16.4, vtop * 8)-(hh * 16.4, (vbot * 8) + 3)
  LINE (hh * 16.5, vtop * 8)-(hh * 16.5, (vbot * 8) + 3)
  LINE (hh * 16.5, (vbot * 8) + 2)-(hh * 66.5, (vbot * 8) + 2)
  LINE (hh * 16.5, (vbot * 8) + 3)-(hh * 66.5, (vbot * 8) + 3)
  GOTO skip1

sub1:
  vpos = CSRLIN
  IF x2 >= x1 THEN
    LOCATE , 11 + x1 * factor / 2: PRINT USING "###.#"; x1;
    LOCATE , 19 + x2 * factor / 2: PRINT USING "###.#"; x2;
    LOCATE , 71: PRINT USING "####.#"; x2 - x1;
    LOCATE vpos + 1, 72: PRINT USING "###.#"; (x2 - x1) * factor;
    PRINT "%"
    LOCATE vpos + 1
    LINE (h + x1 * gfactor, v)-(h + x2 * gfactor, v + 6), , BF
  ELSE
    LOCATE , 11 + x2 * factor / 2: PRINT USING "###.#"; x2;
    LOCATE , 19 + x1 * factor / 2: PRINT USING "###.#"; x1;
    LOCATE , 71: PRINT USING "####.#"; x2 - x1;
    LOCATE vpos + 1, 72: PRINT USING "###.#"; (x2 - x1) * factor;
    PRINT "%"
    LOCATE vpos + 1
    LINE (h + x2 * gfactor, v)-(h + x1 * gfactor, v + 6), , B
  END IF
  RETURN

skip1:
  LINE (2, 2)-(638, 198), , B
  LINE (3, 3)-(637, 197), , B
  LOCATE 2, 2, 0
  x$ = ""
  DO
    x$ = INKEY$
  LOOP UNTIL x$ > ""
NEXT
SCREEN 0
RETURN

'------------------ begin synthesizer subroutine
synthstart:
ERASE subjects, s, score, lsv, aw, stats
ON ERROR GOTO unknownerr
CLOSE
norm = 0: back = 7: high = 1
title$ = testname$ + " SYNTHETIC DATA GENERATOR"
GOSUB screenhead
getfile2:
COLOR high
LOCATE 5, 53: PRINT "          (?=list, Q=QUIT)";
COLOR norm
LOCATE 5, 3: INPUT "               Enter name of file to be created: ",
```

```
file$
file$ = UCASE$(file$)
IF file$ = "?" THEN GOSUB currentfiles: GOTO getfile2
IF file$ = "Q" OR file$ = "" THEN RETURN menu
x = INSTR(file$, ".")
IF x > 0 THEN file$ = LEFT$(file$, x - 1) ELSE file$ = file$ + ext$
DO
  LOCATE 6, 53: PRINT "     ";
  LOCATE 6, 3: INPUT "   Generate data for an experimental group (Y/N)?
", xgrp$
  xgrp$ = UCASE$(xgrp$)
LOOP UNTIL xgrp$ = "Y" OR xgrp$ = "N"
IF xgrp$ = "Y" THEN
  title$ = testname$ + " EXPERIMENTAL GROUP"
  GOSUB screenhead
  grp = 1
  GOSUB getinput
  PRINT
  vv = CSRLIN
ELSE
  vv = 7
END IF
DO
  LOCATE vv, 53: PRINT "       ";
  LOCATE vv, 3
  INPUT "          Generate data for a control group (Y/N)? ", cgrp$
  cgrp$ = UCASE$(cgrp$)
LOOP UNTIL cgrp$ = "Y" OR cgrp$ = "N"
IF cgrp$ = "Y" THEN
  IF INSTR(xgrp$, "Y") > 0 THEN CLS : vv = 5 ELSE vv = 8
  grp = 2
  title$ = testname$ + " CONTROL GROUP"
  GOSUB screenhead
  GOSUB getinput
  PRINT
  vv = CSRLIN
ELSE
  vv = vv + 2
END IF
IF INSTR(xgrp$, "Y") = 0 AND INSTR(cgrp$, "Y") = 0 THEN
  PRINT
  LOCATE , 9: PRINT "You must have either an experimental group"
  LOCATE , 9: PRINT "                      or a control group,"
  LOCATE , 9: PRINT "                    or you may have both."
  PRINT
  LOCATE , 26, 1: PRINT "Press any key to continue ... ";
  x$ = ""
  DO
    x$ = INKEY$
  LOOP UNTIL x$ > ""
  GOTO synthstart
END IF
GOSUB makefile
vv = vv + 1 + pass
msg$ = "Do you want to synthesize another file (Y/N)? "
LOCATE vv, (80 - LEN(msg$)) / 2, 1: PRINT msg$;
x$ = ""
DO
  x$ = UCASE$(INKEY$)
LOOP UNTIL x$ = "Y" OR x$ = "N"
IF x$ = "Y" THEN GOTO synthstart
RETURN
```

```
'------------------------ synthesizer subroutines --------------------

getinput:
vv = 5
COLOR high
LOCATE vv, 53: PRINT "      (3 minimum)";
COLOR norm
LOCATE vv, 3: INPUT "                Enter desired number of subjects:
", sbj$
subjects(grp) = VAL(sbj$)
IF subjects(grp) < 3 THEN BEEP: GOTO getinput
vv = vv + 1
FOR lsv = 1 TO 3
  v = vv
  IF test$ = "T" THEN lsvmin = 20 ELSE lsvmin = 1
  IF lsv = 1 THEN
    IF test$ = "T" THEN lsvmax = 68 ELSE lsvmax = 93
  END IF
  IF lsv = 2 THEN
    IF test$ = "T" THEN lsvmax = 68 ELSE lsvmax = 49
  END IF
  IF lsv = 3 THEN
    IF test$ = "T" THEN lsvmax = 67 ELSE lsvmax = 29
  END IF
  FOR pp = 1 TO 2
    FOR mm = 1 TO 2
    vtab = v + 4 * (lsv - 1) + 2 * (pp - 1) + mm - 1
    htab = LEN(lsv$(lsv)) + LEN(prepost$(pp)) + 23
      DO
        COLOR high
        LOCATE vtab, 53: PRINT "      "; range$(lsv);
        LOCATE vtab, 53 - htab
        COLOR norm
        PRINT "Enter "; minmax$(mm); " "; prepost$(pp); " ";
        PRINT lsv$(lsv); " score: ";
        INPUT "", a$
        s(grp, lsv, pp, mm) = VAL(a$)
        IF VAL(a$) < lsvmin AND VAL(a$) > lsvmax THEN BEEP
      LOOP UNTIL s(grp, lsv, pp, mm) >= lsvmin AND s(grp, lsv, pp, mm)
<= lsvmax
    NEXT mm
  NEXT pp
NEXT lsv
RETURN

makefile:
OPEN "o", 1, file$
pass = 0
FOR grp = 1 TO 2
count = 0
IF grp = 2 THEN hh = 24 ELSE hh = 19
  IF subjects(grp) > 0 THEN
    pass = pass + 1
    DO
      count = count + 1
      LOCATE vv + pass - 1, hh
      PRINT "Generating "; grp$(grp); " subject #"; count; "    ";
      FOR pp = 1 TO 2
        FOR lsv = 1 TO 3
          low = s(grp, lsv, pp, 1)
          hi = s(grp, lsv, pp, 2)
```

```
          GOSUB randomgen
          score(pp, lsv) = rn
        NEXT lsv
      NEXT pp
      IF subjects(1) > 0 AND subjects(2) > 0 AND grp = 2 THEN
        xcount = subjects(1) + count
      ELSE
        xcount = count
      END IF
      PRINT #1, USING "###"; xcount;
      PRINT #1, "                    ";
      PRINT #1, USING "#"; grp;
      PRINT #1, "        ";

      FOR pp = 1 TO 2
        FOR lsv = 1 TO 3
          PRINT #1, USING "##"; score(pp, lsv);
          IF lsv = 3 AND pp = 2 THEN
            REM
          ELSE
            PRINT #1, " ";
          END IF
        NEXT lsv
        IF pp = 1 THEN PRINT #1, "       ";
      NEXT pp
      PRINT #1,
    LOOP UNTIL count = subjects(grp)
  END IF
NEXT grp
CLOSE
RETURN

randomgen:
REM LOW=Lower limit,hi=upper limit,RN=Random number generated
' example: LOW = 1: hi = 49
s1 = VAL(RIGHT$(TIME$, 2))
RANDOMIZE s1
s1 = INT(RND * 1000) + 1
o = INT(RND * 4) + 1
s2 = VAL(RIGHT$(TIME$, 2))
RANDOMIZE s2
s2 = INT(RND * 1000) + 1
IF o = 1 THEN s = s1 + s2
IF o = 2 THEN
  s = ABS(s1 - s2)
  IF s < 1 THEN s = s1
END IF
IF o = 3 THEN s = s1 * s2
IF o = 4 THEN
  s = s1 / s2
  IF s < 1 THEN s = s2
END IF
RANDOMIZE s
rn = INT(RND * (hi + 1 - low)) + low
RETURN
'------------------- end synthesizer subroutine

currentfiles:
ON ERROR GOTO currenterr
SHELL "if exist *" + ext$ + " DIR *" + ext$ + " > files"
filexist = 0
CLOSE
```

```
OPEN "i", 1, "FILES"
COLOR high
LOCATE 18, m: PRINT "Current files: ";
COLOR norm
WHILE NOT EOF(1)
  INPUT #1, text$
  ex$ = RIGHT$(ext$, 3)
  IF INSTR(1, text$, ex$) > 0 THEN
    filexist = 1
    text$ = LEFT$(text$, 8): text$ = RTRIM$(text$)
    IF POS(0) < 70 THEN
      PRINT text$; STRING$(10 - LEN(text$), " ");
    ELSE
      PRINT : LOCATE , m + 15: PRINT text$; STRING$(10 - LEN(text$), "
");
    END IF
  END IF
WEND
endcurrenterr:
CLOSE
IF filexist = 0 THEN PRINT "NONE";
RETURN

makespss:
title$ = "MAKE AN (OPTIONAL) SPSS 'INCLUDE' FILE"
GOSUB screenhead
COLOR high
LOCATE 10, 12: PRINT "We can now create an 'include' file which, if
used"
LOCATE 11, 12: PRINT "with SPSS statistical analysis software
(optional),"
LOCATE 12, 12: PRINT "will calculate additional statistics
automatically."
LOCATE 14, 12: PRINT "To run from the SPSS prompt, type: Include '";
PRINT f$; ".INC'."
COLOR norm
LOCATE 16, 12, 1: PRINT "Do you wish to create this 'include' file
(Y/N)?"
x$ = ""
DO
  x$ = UCASE$(INKEY$)
LOOP UNTIL x$ = "Y" OR x$ = "N"
IF x$ = "N" THEN RETURN
errtitle$ = "MAKESPSS"
ON ERROR GOTO unknownerr
CLOSE 3
finc$ = f$ + ".INC"
OPEN "o", 3, finc$
PRINT #3, "DATA list file = '"; file$; "' /"
PRINT #3, "ID 1-3 GENDER 5-5 BDATE 7-12 CNT 14-16 LNG 18-20 GROUP 22-22
";
PRINT #3, "EDATE 24-29"
PRINT #3, "E1 31-32 E2 34-35 E3 37-38 ODATE 40-45 O1 47-48 O2 50-51 O3
53-54 "
PRINT #3, "HRS 56-57 SEL 59-59."
PRINT #3,
PRINT #3, "include 'TFL-BEST.INC'."
PRINT #3, "include '"; testname$; ".INC'."
CLOSE 3
RETURN

FUNCTION mean (num, den)
```

```
IF den > 0 THEN mean = num / den
END FUNCTION

FUNCTION pearson (o, e, oe, O2, E2, n)
d1 = E2 - e ^ 2 / n
d2 = O2 - o ^ 2 / n
IF d1 > 0 AND d2 > 0 THEN d = SQR(d1 * d2)
r = oe - o * e / n
IF d > 0 THEN pearson = r / d
END FUNCTION

FUNCTION sdev (x, x2, n)
y = ((x2 - (x ^ 2 / n)) / (n - 1))
IF y > 0 THEN sdev = SQR(y) ELSE sdev = 0
END FUNCTION

FUNCTION t2tail (t, df, dt())
FOR a = 1 TO 7
IF ABS(t) >= dt(a - 1, df) AND ABS(t) <= dt(a, df) THEN l = a - 1
NEXT a
IF ABS(t) > dt(6, df) THEN l = 6
IF l = 0 THEN low = 1: high = .2
IF l = 1 THEN low = .2: high = .1
IF l = 2 THEN low = .1: high = .05
IF l = 3 THEN low = .05: high = .02
IF l = 4 THEN low = .02: high = .01
IF l = 5 THEN low = .01: high = .001
IF l = 6 THEN low = .001: high = .0001
tail = (low - high)
tail = tail * (1 - ((ABS(t) - dt(l, df)) / (dt(l + 1, df) - dt(l, df))))
t2tail = tail + high
END FUNCTION

FUNCTION tindgrp (sumx1, sum2x1, n1, sumx2, sum2x2, n2)
'
'                          X1 - X2
't obt = ------------------------------------
'          ------------------------------------
'        /   /  SS1 + SS2  \ /   1    1  \
'       /    | ------------| |  -- + --  |
'     \ /     \ n1 + n2 - 2 / \  n1   n2  /
'
xbar1 = sumx1 / n1
ss1 = sum2x1 - sumx1 ^ 2 / n1
xbar2 = sumx2 / n2
ss2 = sum2x2 - sumx2 ^ 2 / n2
denom1 = (ss1 + ss2) / (n1 + n2 - 2)
denom2 = (1 / n1) + (1 / n2)
IF denom1 > 0 AND denom2 > 0 THEN denom = SQR(denom1 * denom2)
numer = xbar1 - xbar2
tindgrp = numer / denom
END FUNCTION

FUNCTION tpairs (x, x2, n)
d = x / n
ss = x2 - x ^ 2 / n
nn = n * (n - 1)
sss = ss / nn
IF sss > .1 THEN tpairs = d / SQR(sss) ELSE tpairs = 0
END FUNCTION
```

When (or if) the SPSS program is run from the 'include' files created by this program, the following 'include' files are necessary to be in the same subdirectory as the SPSS program, or the SPSS run will abort. They are: TFL-BEST.INC, TOEFL.INC and BEST.INC.

TFL-BEST.INC

```
variable labels /
  BDATE "BIRTHDATE"
  CNT "COUNTRY"
  LNG "LANGUAGE"
  EDATE "PRE-TEST DATE"
  ODATE "POST-TEST DATE".

value labels  /
  GENDER  1  'MALE'
          2  'FEMALE' /
  GROUP   1  'EXPERIMENTAL'
          2  'CONTROL'.

missing value /
  GENDER, GROUP (9).
```

TOEFL.INC

```
select if (sel=1).
variable labels e1 'VOXBOX group PRE-test LISTENING'.
variable labels e2 'VOXBOX group PRE-test STRUCTURE'.
variable labels e3 'VOXBOX group PRE-test VOCABULARY'.
variable labels o1 'VOXBOX group POST-test LISTENING'.
variable labels o2 'VOXBOX group POST-test STRUCTURE'.
variable labels o3 'VOXBOX group POST-test VOCABULARY'.
process if (group=1).
t-test pairs = o1 with e1.
process if (group=1).
t-test pairs = o2 with e2.
process if (group=1).
t-test pairs = o3 with e3.
process if (group=1).
compute var1 = e1+e2+e3.
process if (group=1).
compute var2 = o1+o2+o3.
variable labels var1 'VOXBOX group PRE-test BATTERY'.
variable labels var2 'VOXBOX group POST-test BATTERY'.
process if (group=1).
t-test pairs = var2 with var1.

variable labels e1 'CONTROL group PRE-test LISTENING'.
variable labels e2 'CONTROL group PRE-test STRUCTURE'.
variable labels e3 'CONTROL group PRE-test VOCABULARY'.
variable labels o1 'CONTROL group POST-test LISTENING'.
variable labels o2 'CONTROL group POST-test STRUCTURE'.
variable labels o3 'CONTROL group POST-test VOCABULARY'.
process if (group=2).
t-test pairs = o1 with e1.
process if (group=2).
t-test pairs = o2 with e2.
process if (group=2).
t-test pairs = o3 with e3.
```

```
process if (group=2).
compute var1 = e1+e2+e3.
process if (group=2).
compute var2 = o1+o2+o3.
variable labels var1 'CONTROL group PRE-test BATTERY'.
variable labels var2 'CONTROL group POST-test BATTERY'.
process if (group=2).
t-test pairs = var2 with var1.

compute var1 = o1-e1.
compute var2 = o2-e2.
compute var3 = o3-e3.
compute var4 = o1+o2+o3-e1-e2-e3.
variable labels var1 'VOXBOX/CONTROL LISTENING gain'.
variable labels var2 'VOXBOX/CONTROL STRUCTURE gain'.
variable labels var3 'VOXBOX/CONTROL VOCABULARY gain'.
variable labels var4 'VOXBOX/CONTROL BATTERY gain'.
t-test groups = group(1,2) / var = var1.
t-test groups = group(1,2) / var = var2.
t-test groups = group(1,2) / var = var3.
t-test groups = group(1,2) / var = var4.


BEST.INC
--------
select if (sel=1).
variable labels e1 'VOXBOX group PRE-test ORAL'.
variable labels e2 'VOXBOX group PRE-test READ'.
variable labels e3 'VOXBOX group PRE-test WRITE'.
variable labels o1 'VOXBOX group POST-test ORAL'.
variable labels o2 'VOXBOX group POST-test READ'.
variable labels o3 'VOXBOX group POST-test WRITE'.
process if (group=1).
t-test pairs = o1 with e1.
process if (group=1).
t-test pairs = o2 with e2.
process if (group=1).
t-test pairs = o3 with e3.
process if (group=1).
compute var1 = e1+e2+e3.
process if (group=1).
compute var2 = o1+o2+o3.
variable labels var1 'VOXBOX group PRE-test TOTAL'.
variable labels var2 'VOXBOX group POST-test TOTAL'.
process if (group=1).
t-test pairs = var2 with var1.

variable labels e1 'CONTROL group PRE-test ORAL'.
variable labels e2 'CONTROL group PRE-test READ'.
variable labels e3 'CONTROL group PRE-test WRITE'.
variable labels o1 'CONTROL group POST-test ORAL'.
variable labels o2 'CONTROL group POST-test READ'.
variable labels o3 'CONTROL group POST-test WRITE'.
process if (group=2).
t-test pairs = o1 with e1.
process if (group=2).
t-test pairs = o2 with e2.
process if (group=2).
t-test pairs = o3 with e3.
process if (group=2).
compute var1 = e1+e2+e3.
process if (group=2).
```

```
compute var2 = o1+o2+o3.
variable labels var1 'CONTROL group PRE-test TOTAL'.
variable labels var2 'CONTROL group POST-test TOTAL'.
process if (group=2).
t-test pairs = var2 with var1.

compute var1 = o1-e1.
compute var2 = o2-e2.
compute var3 = o3-e3.
compute var4 = o1+o2+o3-e1-e2-e3.
variable labels var1 'VOXBOX/CONTROL ORAL gain'.
variable labels var2 'VOXBOX/CONTROL READ gain'.
variable labels var3 'VOXBOX/CONTROL WRITE gain'.
variable labels var4 'VOXBOX/CONTROL TOTAL gain'.
t-test groups = group(1,2) / var = var1.
t-test groups = group(1,2) / var = var2.
t-test groups = group(1,2) / var = var3.
t-test groups = group(1,2) / var = var4.
```

APPENDIX C

INFORMATION ON VOXBOX

APPENDIX C

INFORMATION ON VOXBOX

VOXBOX Courseware Scope and Sequence

Level One Content Summary: Subjects and Lesson Numbers

Age	7
Classroom objects	2, 3
Clothing	9,10,12
Colors	11
Directions	12,19
Family	15
Geography	6,19
Greetings	1
Measurements	20
Money	14
Names	1
Numbers	1,15,16
School titles	5
Time	21,23,27,28

Level One Grammar Summary: Subjects and Lesson Numbers

Adjectives	24
Adverbs	19,23,24,28
Article	2
Be (to be)	5, 6,10,17,18
Commands	13
Continuous present	10
Have (to have)	3, 8
Negatives	6, 8,13,18,26
Noun plurals	2, 3, 5, 7
Past tense	17,18,25,26,27
Possessive	4, 5,13
Possessive adjective	4
Prepositions	17,18,19,28
Present tense	11,15,16,22
Pronouns	3,11,13
Questions	2, 3, 8,9,14,15,19,20, 21,24,25,27,29
Tag endings	9
Verbs	18,19,20,22,25,26,27,28

Level Two Content Summary: Subjects and Lesson Numbers

Animals	20,21,22
Birthday	4
Family	15,18
Geography	2,22
Illness and injury	10,11
Locations	16
Meeting people	18
Names	1
Occupations	16
Parts of the body	8, 9
Personal appearance	17
School	5, 6, 7
Shapes	8
Social status	17
Time	1, 3,14
Weather	12,13

Level Two Grammar Summary: Subjects and Lesson Numbers

Adverbs	8,12,13,22
Commands	7
Comparative	19,20,22
Conjunctions	14
Exclamations	17
"Fewer" vs. "less"	20
Future tense	1, 2, 3, 4,10,14
Indefinite words	18
Modal verbs	6, 9,10,11,12,14
Negatives	1, 2, 3, 4, 6, 9,10,11,14,18
Nouns	5
Past tense	10,13,14,22
Possessive	18
Pronouns	18
Questions	1, 3,10,12
Superlative	21,22
Verbs	4-16,22

Level Three Content Summary: Subjects and Lesson Numbers

Automobile	15
Bank (At the)	18
Flying	18
Food and meals	1, 2, 3, 4, 5, 6
Government	13
Holidays	17,18
House and home	7, 8,10,11,12
Post Office	15
Sports	16
Stores	12,14
Yard and Garden	9

Level Three Grammar Summary: Subjects and Lesson Numbers

Adjective+preposition	20
Adverbs	6,10
Be (to be)	9
Commands	16
Confusing words	22
Conjunctions	15
Conditional sentences	7, 8,14
Contractions	8
Future tense	11,17
Gerunds	2,18
Impersonal pronouns	10
Indirect objects	1
Indirect sentence	8
Infinitives	1, 2,11,18
Modal verbs	11
Necessity	17
Opinions	16
Passive voice	11
Past tense	7, 9,11,17
Past participle	4, 5
Past perfect tense	6, 7, 9
Prepositions	12
Present tense	7, 9,11,17
Present perfect tense	5, 9,11
Questions	5,13,16
Reflexive pronouns	10
Relative pronouns	3,12
Subjunctive	9
Subordinate clauses	15,18
Tag questions	8
"Too"	9
Verbs	2, 3, 5-18
Verb+preposition	19,20,21
"Wh" words	12,13
Wishes	17

VOXBOX LESSONS - TABLE OF CONTENTS - LEVEL ONE

LESSON	TOPICS	SENTENCE STRUCTURE
1	Numbers 1-10; asking names	
2	Classroom objects	Questions; noun plurals
3	Classroom objects	"to have"; pronouns
4	Possession	Poss. adjectives
5	School people	Verb "to be"
6	Countries & nationalities	"to be"; neg. sentences
7	Age; numbers 11-20	"to have"; neg. sentences
8	Asking information	Info. questions
9	Men's clothing	Short answers; tag endings
10	Women's clothing	Progression
11	Colors	Substitution of nouns
12	Other clothing	Possessive pronouns
13	Numbers 30-100	Commands or instructions
14	American money; asking prices	"How much...?" "How many...?"
15	Numbers 100-1000	
16	Ordinal numbers	Substitution of sentences
17	Expressing locations	Prepositions; "to be" (past tense)
18	Expressing locations	"to be" (past tense negative)
19	Distance	
20	Measurements	"There is..."; "There are..."
21	Time of day	
22	Daily schedule	3rd endings for the verb
23	Today's schedule	Object pronouns
24	Length of time	Adverbs
25	Yesterday's schedule	Past tense
26	Yesterday's schedule	Past tense; neg. sentences
27	Length of time (past)	Past tense
28	Frequency of time	Position of time adverbs

VOXBOX LESSONS - TABLE OF CONTENTS - LEVEL TWO

LESSON	TOPICS	SENTENCE STRUCTURE
1	The week	Future tense
2	Weekly activities	Progressive form of future tense
3	Months of the year	Contractions (future tense)
4	Dates Dialogues and readings	Substitutes for future tense
5	School subjects	Two nouns together
6	School places Permission or possibility	"may"
7	Classroom instructions Dialogues and readings	Commands Idioms
8	The body	
9	The head	"can"
10	Accidents and sickness	"could"
11	Symptoms and remedies Obligation	"should"
12	Weather Obligation	"ought"
13	Tomorrow's weather	Emphatic forms
14	Seasons Strong obligation	"must"
15	Family	Omission of infinitive
16	Addresses and professions	
17	Describing relatives	Exclamations
18	Family introductions	Indefinite words
19	Comparing two people	Comparative adjective forms
20	Comparing two animals	Comparative adjective forms
21	Comparing more than two things	Superlative adjective forms
22	Comparing actions	Comparative adverb forms

VOXBOX LESSONS - TABLE OF CONTENTS - LEVEL THREE

LESSON	TOPICS	SENTENCE STRUCTURE
1	Fruits	Indirect objects Infinitives without "to"
2	Vegetables	Verbs followed by gerund or infinitives
3	Dried foods	Relative pronouns
4	Expressing past time	Irregular past participles
5	Meals: breakfast	Present perfect tense; contractions and tag endings
6	Meals: lunch, dinner	Past perfect tense
7	The house	Conditions
8	The bedroom	Conditions: contractions and tag endings
9	The garden	Subjunctive
10	The bathroom	Reflexive pronouns
11	The kitchen	Passive voice
12	The dining room	Verbs with prepositions
13	City and government	"to tell"; "to say"
14	Stores and services	Sequence of tenses
15	City traffic	Subordinated clauses
16	Sports	Indirect speech
17	Legal holidays	Subordinated clauses
18	A trip by plane	Subordinated clauses
19	Idiomatic expressions	Verbs with prepositions
20	Idiomatic expressions	Adjectives with prepositions
21	Idiomatic expressions	"to get"
22	Commonly confused words	